THE FOUNDRY

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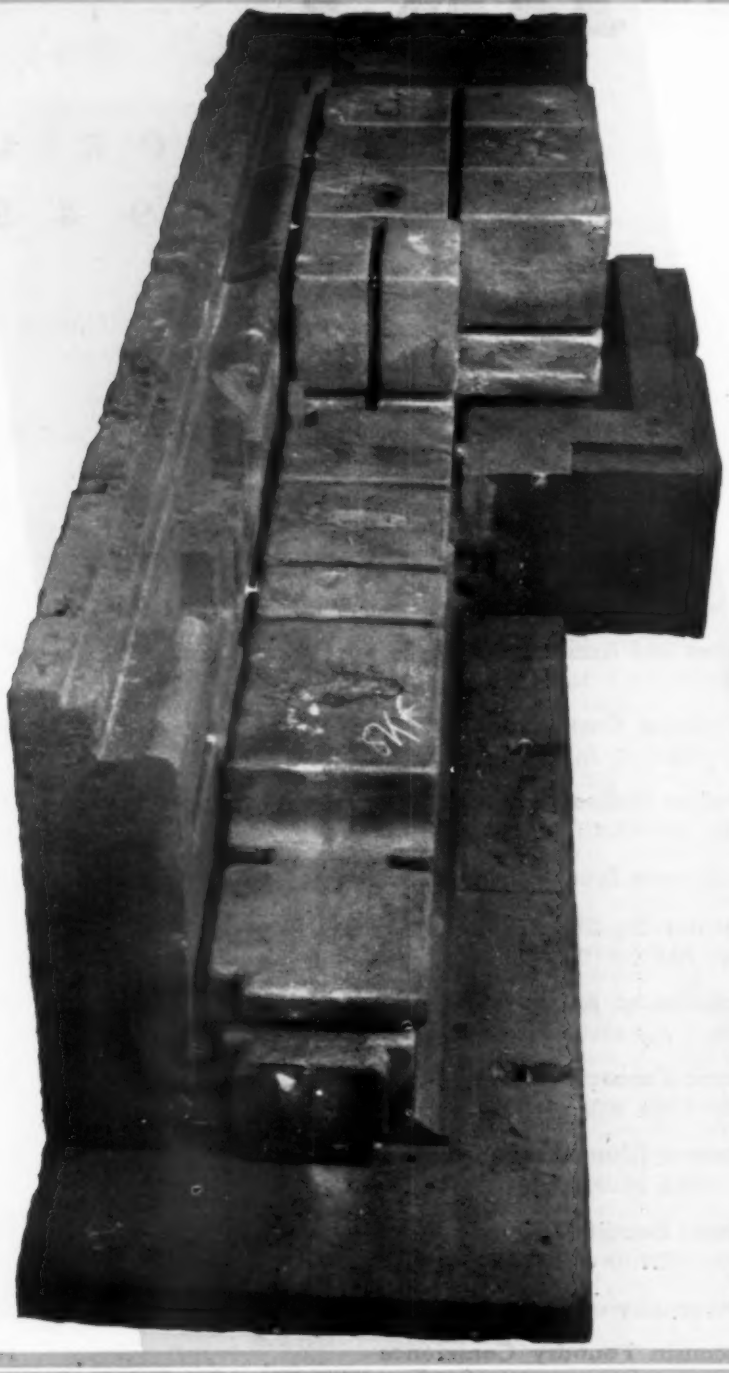
for heavy castings



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Shall It Be Soldiers Or Castings for War?

RECENT news dispatches report Admiral Nimitz has revealed a shortage of spare parts which has immobilized a lot of war equipment in the Pacific battle area. That castings form important components in the production of such spare parts is shown in the report of the February meeting of the Gray Iron Advisory Committee of the WPB, where much of the discussion was devoted to increasing production of spare parts for internal combustion engines and castings for the repair of battle-damaged ships.

Manpower shortages and inability to secure full productivity in certain instances (page 136) are preventing production of much needed castings. On March 14, the Gray Iron Founders' Society once again called attention to the dangerous manpower situation being created by the continued induction of trained workers into the armed services. In the following telegram addressed to 15 top men in the military services, the WPB, WMC, and the Department of Labor, Watts Rose, executive vice president of the society, asked for action on this vital problem.

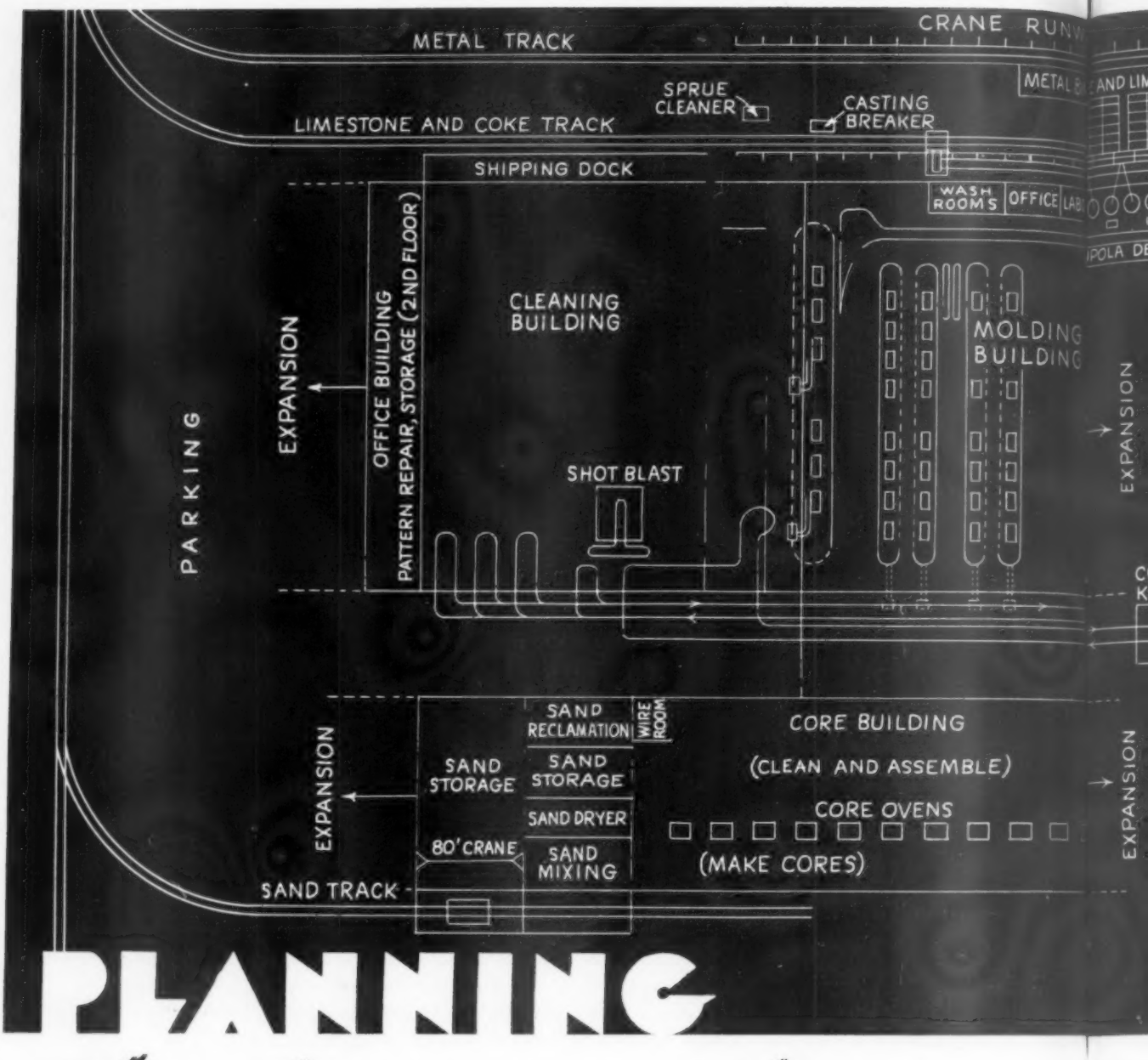
"The Gray Iron Founders' Society, national association of gray iron foundries, respectfully calls attention to the fact that the Selective Service System continues to drain increasingly essential, indispensable and irreplaceable semiskilled and skilled workers from the gray iron foundry industry despite the provisions of amended Local Board Memorandum No. 115 that registrants aged 18 through 29 may be retained or placed in deferred classes if they are 'necessary to and regularly engaged in' an activity in war production. You are aware that the manufacture of castings is a critical activity and that the gray iron foundry industry is basic to and highly critical in the production of many other critical items. For many months gray iron foundries have been under terrific pressure for production and have staggered along with sharply reduced manpower. They have tried all the alternatives, employing women, foreign and other labor. Now, indications are that further withdrawal of semiskilled and skilled workers may entail disaster. The industry will continue to do its utmost to provide castings for all critical programs, but it cannot perform miracles. We urge, therefore, your serious consideration of the situation and the danger it threatens."

This eloquent plea applies not only to gray iron, but to steel, malleable iron and nonferrous castings as well.

The time has arrived for a sound decision based on facts. The military must decide if it is more important to grab these foundry workers for the army and navy than it is to have castings in quantities sufficient to meet production schedules for war equipment and to supply the requirements for spare parts in the theaters of war.

The military cannot have both.

Frank G. Steinebach
Editor



PLANNING

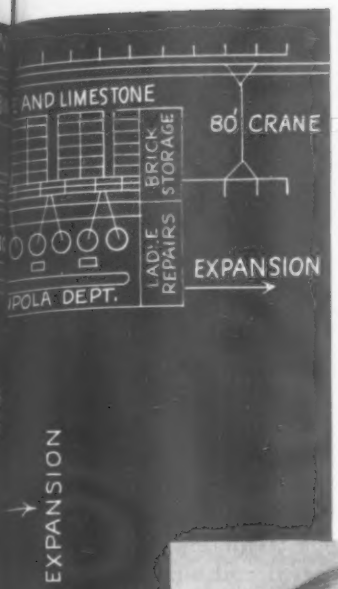
The Foundry of Tomorrow

Writing from broad experience in foundry design, the author suggests an ideal layout for a production-type gray iron foundry. Many of his recommendations are equally applicable to other types of foundries

PAST experience in what is good and a knowledge of what should and can be made better, combined with a freedom from fear of turning from past practice when it can be improved, should provide the basis of planning for the foundry of tomorrow. Numerous considerations necessarily enter into this planning, and each must be weighed carefully if a proper balance is to be achieved in the various factors which contribute to the success of a foundry or any other industrial enterprise.

Selection of Site—Broadly speaking, both the worker and the product must be considered. First, it must be decided what kind of castings are to be made and the quantity. If there is not a definite aim a clear decisive plan cannot be formulated. Then we must study the factors affecting this production—such as the market area, labor supply, material sources, availability of transportation both for material and labor, the utilities, the disposal or refuse material and the bearing value of the soil in selecting the site. It is usually more economic to have the foundry convenient to the market than to the raw material, assuming a choice must be made.

General Arrangement—Next we must decide where we



Sketch showing general arrangement of departments in hypothetical gray iron foundry intended to make automotive castings for production of 1000 or more cars a day

By JOHN E. LINABURY
General Motors Corp., Detroit

will receive the incoming materials, metal, coke, sand and supplies, and how and where the product and the refuse will be taken away. With the receiving points established, we can plan the location of the various departments and arrange them so that the product moves from one to the next by the most direct route and eventually arrives at the shipping point with the minimum amount of conveying or trucking. Future expansion—also the consequence of reduced schedules—should be kept in mind both in selecting the site and locating the buildings. For future expansion, space should be left so each department can increase its size in the correct direction. For a conveyorized molding department, future expansion would probably be accomplished by adding more conveyor lines and not by lengthening present ones, so the increase would take place sideways instead of in a general lengthwise direction.

Equipment Arrangement — Location of equipment should be given the closest attention, and motion studies should be made in determining exact locations and heights. Placing a conveyor a foot farther away than necessary may require two extra steps for each operation. These steps take both time and energy from the worker and you usually pay for both. The same is true in establishing the correct height for machines and benches to reduce lifting and back-bending to a minimum. Good mechanized equipment should be provided to prevent fatigue, to save time and labor and to insure uniform, accurate work, and since labor costs are higher we can afford to pay more for such equipment and use it on more operations.

Welfare—More attention should be given to employes' safety, health and comfort. This means a clean, warm, well lighted and well ventilated foundry, but it also means such things as adequate, clean, ventilated lockers, locker rooms, wash rooms and lunch rooms. These things help to reduce grievances and labor turn-over and attract a better class of men.

Incoming Material—For the purpose of this discussion let us plan a gray iron foundry to produce automotive castings for a prodution of 1000 or more cars a day. The general layout of such a foundry is shown in the sketch. Service tracks lead in at the upper side from the main spur at the left. This track will serve the metal storage yard under the craneway and also bring brick to the brick storage building. The metal will be unloaded by magnet from the cars to concrete bins. The use of concrete bins increases the capacity of the yard, keeps the various kinds of metal separate and gives it a more orderly appearance.

A second track into the lower side of the craneway will be used to bring in coke and, as it passes by the shipping room dock, to ship out castings. Some distance from the end of this track will be located a track hopper for dumping coke from hopper bottom cars. From this hopper coke will be fed to an inclined belt just below the crane runway which will take it up to a row of coke bins. A shuttle belt will discharge it into the desired bin. A skip hoist and shuttle car might be used here if desired. The hopper is located back from the end of the track to facilitate handling cars after emptying.

Metal Preparation—Under the craneway at a point convenient for delivery from the foundry would be placed a mill for cleaning the gates and sprue before remelting. This would be charged by a skip hoist and operated only when there was metal for it. A casting breaker would also be located nearby for breaking up larger castings such as cylinder blocks so that no scrap pieces would weigh over 75 pounds.

Melting Department—At the upper right-hand side a short distance below the metal storage yard we will place the cupola department, and since we will be melting two or three kinds of metal but in quite different quantities, we will use six or more cupolas, three in use and three being repaired each day. For each set of cupolas we will provide in the metal yard a scale car with a bottom dump weigh hopper and a dial scale. This car will run between two sets of inclined charging bins, each with enough compartments to take all the different items making up the charge. Usually we drag the pig and scrap from the bin into the hopper by means of a hook, or use the crane to pick up and drop the metal. (*Please turn to page* 230)

Heat Treatment of Magnesium A

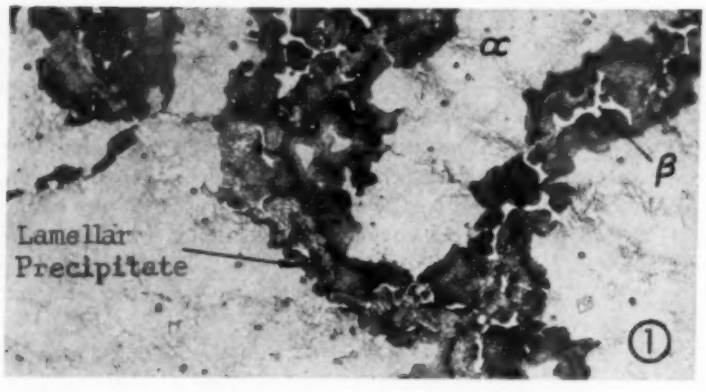


Fig. 1—Photomicrograph showing microconstituents present in 6 per cent aluminum 3 per cent zinc magnesium alloys

Fig. 2—Previously solution treated and aged sample heated to 750 degrees Fahr. in 20 minutes. Absence of burning results from more rapid solution of low melting constituents in previously heat treated material

Fig. 3—As-cast sample heated to 750 degrees Fahr. in 20 minutes. Dark areas are voids and indicate severity of burning

Fig. 4—Effect of time at solution temperature on beta compound rating

THE common sand cast magnesium alloys in use in this country at the present time are primarily ternary alloys of aluminum and zinc with magnesium. The common impurities are manganese, silicon, copper and nickel. These alloys are frequently used in the heat treated condition as they are susceptible to precipitation hardening treatments. The solution treated state is used in applications requiring high ductility, and the solution treated and aged condition is used where improved yield strength is necessary at some sacrifice in ductility.

This paper presents data on the effect of pouring temperature, initial structure, heating rate prior to solution treating, solution temperature, solution time, cooling rate from the solution temperature, aging temperature and aging time on resultant static physical properties and microstructure of fine grained 6 per cent aluminum—3 per cent zinc alloys. A brief study of dimensional changes during heat treatment is included.

The data reported here were obtained on the alloy whose nominal composition is as follows: Aluminum, 6.0 per cent; zinc, 3.0 per cent; manganese, 0.15 per cent minimum; silicon, 0.30 per cent maximum; copper, 0.05 per cent maximum; nickel, 0.01 per cent maximum; other impurities, 0.30 per cent maximum; magnesium, remainder.

Heat Treatment Affects Physical Properties

The results were obtained on standard 0.500-inch test bars cast four in a dry sand mold unless otherwise indicated. The bars were cast with 20 per cent virgin metal and 80 per cent clean remelt scrap. The metal was superheated in 450-pound crucibles for 15 minutes above 1600 degrees Fahr. with a maximum temperature attained during superheating of 1675 degrees Fahr. The bars were poured at pouring temperatures between 1300 and 1460 degrees Fahr. The resulting grain size on all bars was between 0.003-inch—0.005-inch average grain diameter.

The standard heat treatment applied to the test bars unless otherwise indicated was:

1. Charge in a furnace below 500 degrees Fahr.
2. Heat to 650 degrees Fahr. and hold for 15 minutes.
3. Heat from 650 to 725 degrees Fahr. in 2 hours.
4. Hold at 725 degrees Fahr. for 12 hours.
5. Air cool.
6. Age at 350 degrees Fahr. for 16 hours.
7. Air cool.

The first four steps of this cycle are for the purpose of dissolving a compound of magnesium, aluminum and zinc, commonly referred to as the *beta* constituent, in magnesium. The cooling in step No. 5 must be rapid enough to prevent the precipitation and agglomeration of the *beta* into coarse particles.

The aging temperature and time is chosen to allow precipitation of particles of optimum shape, size and distribution to give the desired physical properties.

For the sake of brevity, the following abbreviations will be used throughout this paper:

Alloys

By
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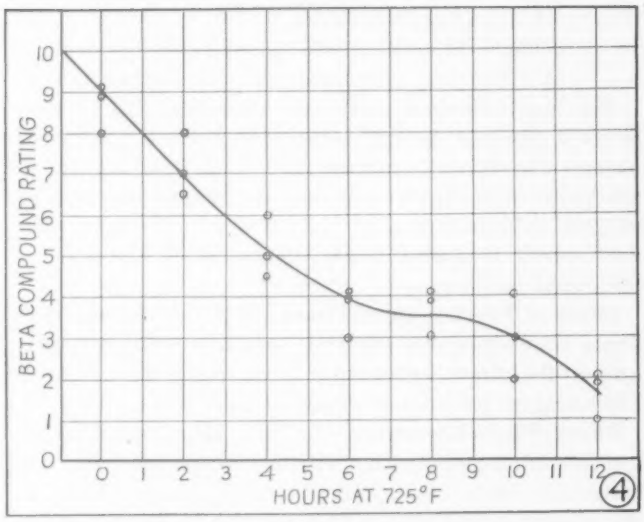


Table I—Effect of Heat Treatment on Physical Properties

	No. Bars	Yield Str. psi.	Ult. Str. psi.	% Elong. 2 in.	Brinell Hardness
A.C.	10	14,500	30,000	7.0	62
H.T.	9	14,800	41,000	15.0	60
H.T.A.	50	18,500	39,000	6.0	72

TABLE II—Effect of Pouring Temperature on H.T.A. Physical Properties

...ring Temp.	Ult. Str. psi.	Yield Str. psi.	% Elong. 2 in.	Brinell* Hardness
...30° F.	38,860	18,360	5.9	72.5
1340° F.	39,060	18,380	6.0	74
1430° F.	38,220	18,600	5.9	72
1435° F.	39,200	18,440	6.2	73
1460° F.	39,000	18,500	6.2	73

All values are the results of the average of 50 bars.
*500 kg. load, 10 mm. ball.

Table III—Effect of Initial Structure on H.T.A. Physical Properties

	As-Cast*	Previously H.T.A.*
Ultimate str., psi.	39,000	39,000
Yield str., psi.	18,500	18,000
% Elong., 2 in.	6.5	6.0
Brinell hardness	72	75

*Average 17 bars.

Table IV—Effect of Heating Rate on H.T.A. Physical Properties of As-Cast Material

...me from Room ...mp. to 725° F.	20 Min.	Normal Preheat
Ult. str., psi.	38,000	39,000
Yield str., psi.	17,800	18,500
% Elong., 2 in.	6.0	6.5
Brinell hardness	74	72
No. bars	8	17

Table V—Effect of Solution Temperature on H.T.A. Physical Properties

No. Bars	Solution Temp. ° F.	Ult. Str. psi.	Yield Str. psi.	% Elong. 2 in.	Brinell Hardness
14	700	41,000	17,700	7.0	75
12	710	40,000	18,300	7.0	73
17	720	38,700	17,900	6.0	75
13	730	40,300	17,800	7.8	74
14	740	40,000	17,300	7.5	73
12	750	40,000	17,300	8.0	71

Table VI—Effect of Varying Solution Time on H.T.A. Physical Properties

Hours at 725° F.	No. Bars	Ult. Str. psi.	Yield Str. psi.	% Elong. 2 in.	Brinell Hardness
6	2	40,000	18,500	6.0	74
8	2	39,300	19,650	4.0	75
9	2	39,800	18,400	5.5	71.5
12	2	39,600	18,800	6.5	72.8

Table VII—Effect of Cooling Rate on H.T.A. Physical Properties

Cooling Method	Time to Cool from 725° F. to 250° F.	No. Bars	Ult. Str. psi.	Yield Str. psi.	% Elong. 2 in.	Brinell Hardness
Slow Furnace	8 hrs.	13	35,700	18,000	5.7	72
Fast Furnace	15 min.	16	38,100	18,500	7.0	70
Air	220 sec.	10	39,000	18,000	6.5	72
140° F. Oil	66 sec.	10	42,800	19,000	8.0	78
Boiling Water	44 sec.	10	43,500	20,000	7.0	80
70° F. Water	32 sec.	10	43,500	19,400	7.5	75
Ice Water	22 sec.	10	43,800	19,800	7.5	79

Table VIII—Effect of Various Aging Temperatures on Physical Properties

Initial Structure	No. Bars	Aging Temp. ° F.	Aging Time-Hours	Yield Str. psi.	Ult. Str. psi.	% Elong. 2 in.	Brinell Hardness
As cast	14	250	22	15,100	41,600	15.4	63
As cast	17	350	16	18,500	39,000	6.5	72
As cast	12	450	16	17,600	36,900	7.0	74
Previously H.T.A.	13	250	22	14,500	40,600	14.5	63
Previously H.T.A.	17	350	16	17,900	39,000	5.9	75
Previously H.T.A.	11	450	16	17,560	38,800	7.3	71

Table IX—Effect of Heat Treatment on Dimensional Changes

Section Size	Length Increase H.T.	(Inches per inch) H.T.A.
1-inch diam.	0.0002	0.0008
2-inch diam.	0.0004	0.0006
3-inch diam.	0.0003	0.0009
Average	0.0003	0.0008

Section Size	Diameter Increase	(Inches per inch)
1-inch diam.	0.0006	0.0007
2-inch diam.	0.0004	0.0007
3-inch diam.	0.0009	0.0011
Average	0.0006	0.0008

A.C. —As-cast material
H.T. —Solution treated material
H.T.A.—Solution treated and aged material

The heat treat cycle previously described will produce physical property changes as shown in Table I. The yield strengths in Table I and all other such values given in this paper were determined by the extension under load method. An extension of 0.0089-inch in 2 inches was used which is approximately equivalent to the 0.2 per cent offset method.

Effect of Pouring Temperature on H.T.A. Properties—There is no significant effect of variable pouring temperature on the physical properties in the range from 1330 to 1460 degrees Fahr. as is shown in Table II.

Effect of Initial Structure—In Table III is shown the effect of initial structure on physical properties when the material is heated in 2 hours from 650 degrees Fahr. to the solution temperature. One set of bars was in the as-cast condition and the second set had been previously solution treated and aged. These results indicate the properties are equivalent with a slow preheating cycle.

Effect of Heating Rate—In Table IV is shown the effect of rate of preheat on the properties of as-cast material. One batch of bars was heated directly to 725 degrees Fahr. It required 20 minutes to reach this temperature. Results are compared with those produced by the normal preheating cycle. It may be seen the properties are slightly superior in slowly preheated material.

Effect of Solution Temperature—In Table V are shown the results of varying solution temperatures on heat treated and aged properties. The bars used in this series had previously been solution treated and aged.

These data indicate temperatures as high as 750 degrees Fahr. produce satisfactory properties if no *burning* occurs during heat treatment. Temperatures as low as 700 degrees Fahr. also produce good properties. The reason for the selection of 725 degrees Fahr. as the standard solution temperature will be discussed later.

Effect of Solution Time—In Table VI are shown some limited data on the effect of solution time on physical properties. It will be observed that times as short as 6 hours produce satisfactory physical properties in sand cast test bars.

Fig. 1 is a photomicrograph showing microconstituents referred to in this paper.

Metallographic examination on pieces cut from test bars

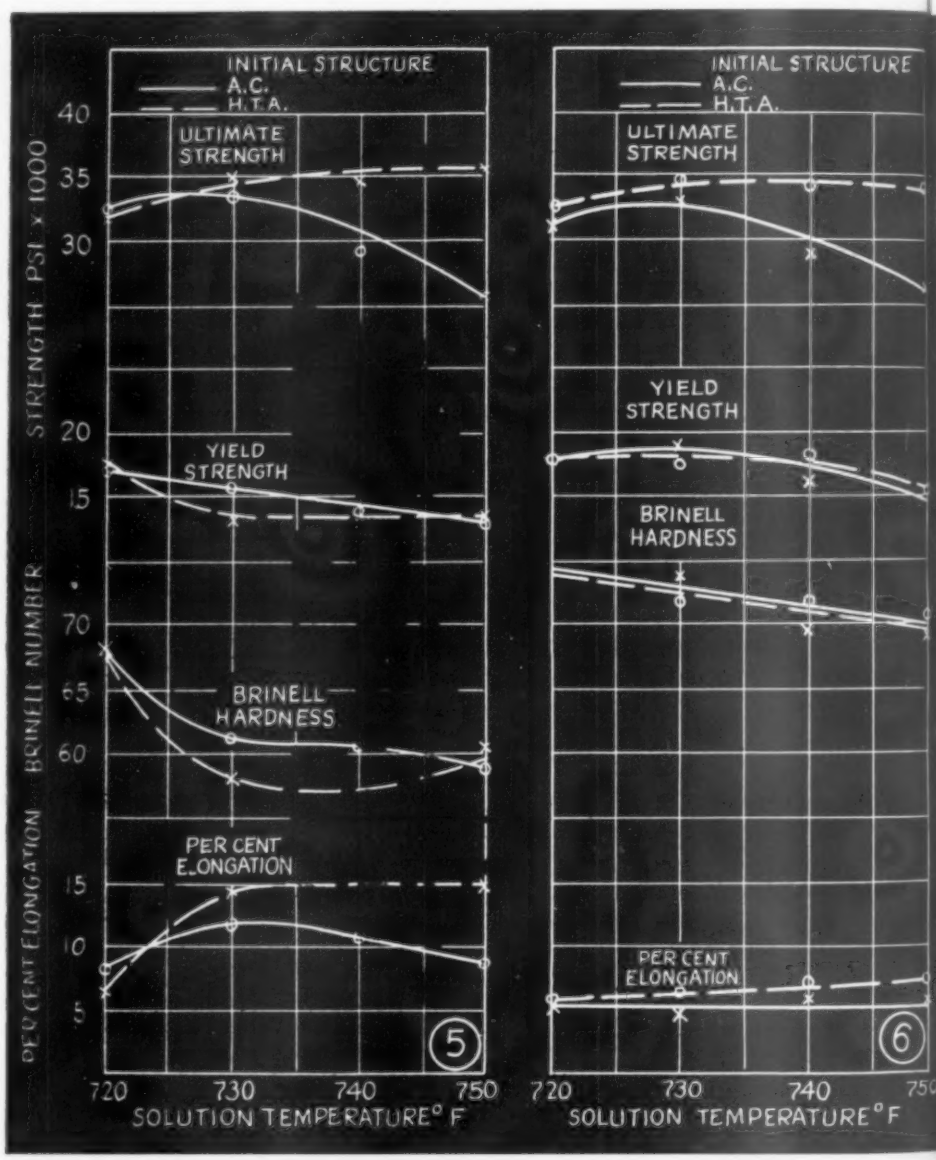


Fig. 5 — Effect of solution temperature on solution treated material. Here and in Fig. 6 are shown results obtained for combination of rapid heating rates with varying initial structures

Fig. 6 — Effect of solution temperature on solution treated and aged material. Inferior properties produced in as-cast material compared with previously heat treated material can be traced to greater burning of the former when heated above 720 degrees Fahr.

Fig. 7 — Aging curves at 350 and 450 degrees Fahr. More rapid aging at 450 degrees Fahr. is to be noted with rapid decrease in ultimate strength and early increase in yield strength

Fig. 8 — Effect of aging time on lamellar constituent rating. Precipitate forms most rapidly at 450 degrees and not at all at 250 degrees

Fig. 9 — Effect of amount of lamellar constituent on yield strength, showing greater influence than is effect of lamellar constituent on ultimate strength

gave the results in Fig. 4, which shows the variation in *beta* rating with time at solution temperature. The numerical system used is that proposed by George[1] and commonly used throughout the industry. No. 0 shows absence of *beta* and 10 is the amount present in material as cast. Intermediate amounts are correspondingly numbered.

Comparison of Fig. 4 with Table VI shows that acceptable physical properties are attained before solution of the *beta* constituent is complete. The effect of these *beta* nuclei on fatigue and impact properties is worthy of further investigation.

Effect of Cooling Rate—To determine the effect of cooling rate from the solution temperature on physical properties, seven different batches of test bars were cooled, as shown in Table VII. The cooling rates were determined by axially drilling a test bar, imbedding a couple so the bead was at the center of the reduced section and cooling in a manner similar to that used for cooling the test bars.

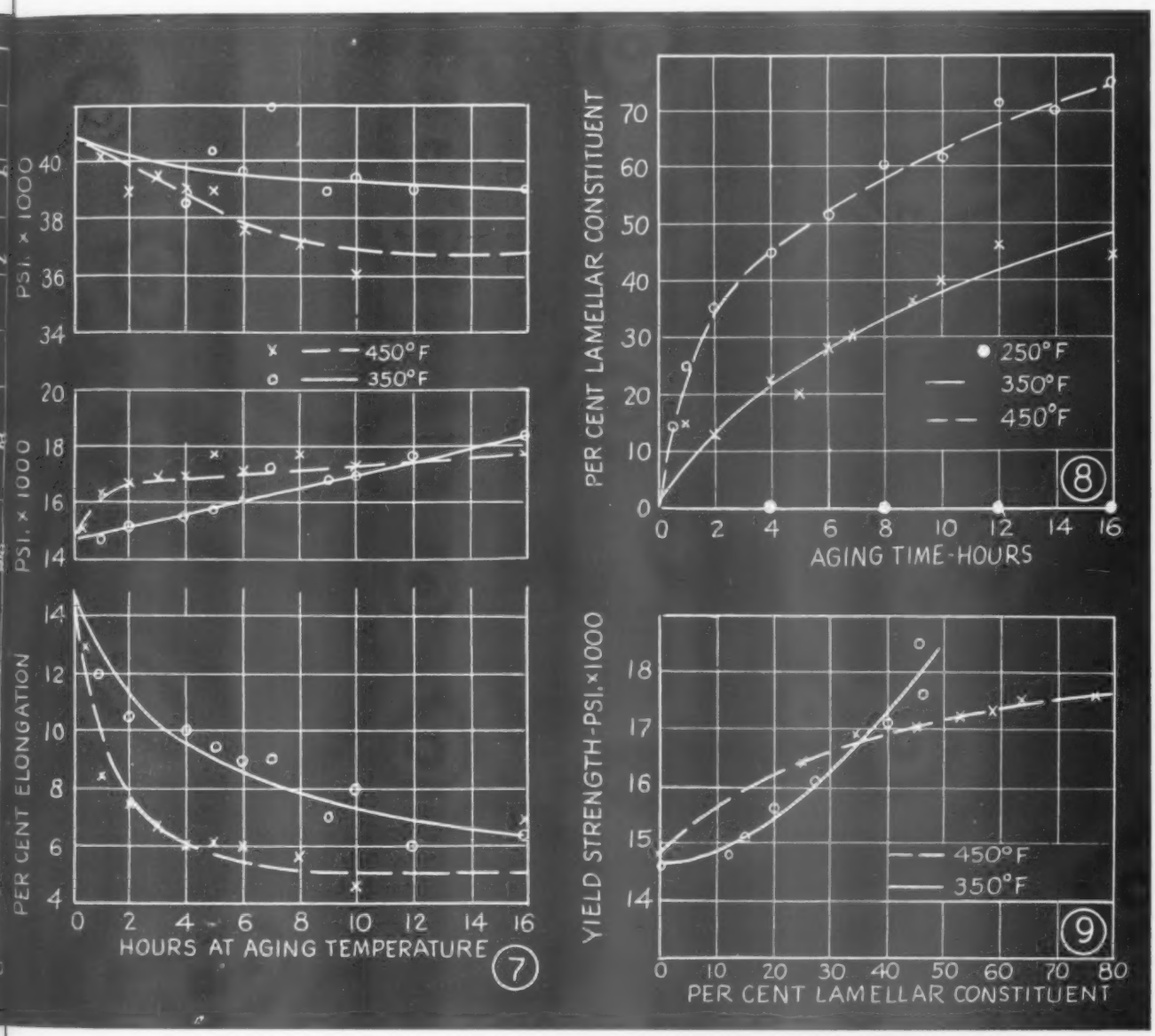
The time interval to cool from 725 to 250 degrees Fahr. was selected as the criterion for cooling rate, since no visible precipitation of the lamellar constituent takes place at aging temperatures of 250 degrees.

It should be observed that the ultimate strength begins to decrease appreciably with cooling rates slower than 66 seconds.

Effect of Initial Structure with a Rapid Heating Rate—Figs. 5 and 6 show the results obtained for a combination of rapid heating rate with varying initial structures. The bars were not preheated, but were heated to the solution temperature in 20 minutes. The inferior properties produced in as-cast material compared with previously heat treated material can be traced to the greater amount of *burning* of as-cast material when heated above 720 degrees Fahr. A comparison of the photomicrographs of Figs. 2 and 3 shows the extreme *burning* of as-cast material heated to 750 degrees Fahr. and the almost complete absence of such *burning* in previously heat treated material. The dark areas are voids and indicate severity of *burning*.

The absence of *burning* in Fig. 2 results from the more rapid solution of the low melting constituents in previously heat treated material.

Samples of previously heat treated and aged materials were removed from the solution furnace at various temperatures during rapid heating (*Please turn to page* 236)



Injuries and Accident Causes IN THE FOUNDRY INDUSTRY

This second of four articles analyzing the causes of accidents in the foundry industry points out the hazards in melting and cleaning departments and discusses safety programs and first aid facilities. The first installment appeared in the March issue

By FRANK S. McELROY
and
GEORGE R. McCORMACK
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United States Department of Labor

THE procedure of *dropping the bottom* to clear the furnace presents the most spectacular hazard of cupola operations. Cupola workers also are exposed to a wide variety of other hazards such as burns from spattering metal while tapping, or from slag thrown from the slag hole; injury from falling objects, as may occur when a scrap iron pile collapses or when workmen on the charging floor drop tools or other objects into or outside the cupola; injury from explosion; injury from falls while cleaning or repairing the cupola, or from falling off the charging floor into the cupola or onto the ground; and eye injuries from flying particles or radiations from the hot metal.

Charging operations generally involve the use of an elevator and in some cases are otherwise mechanized Considerable manual labor is involved, however, even in the highly mechanized plants, and the workers are constantly exposed to the hazards of crushed hands or feet while moving heavy pieces of scrap or pig iron and to cuts from the sharp edges of scrap. Elevators frequently are hazardous, and there is danger of burns from sparks thrown through the open charging door. Insulated clothing, gloves, goggles, hard hats, and safety shoes can help to reduce the possibilities of injury to cupola workers. Good housekeeping practices around the furnace, particularly on the charging floor, and the provision of safety devices—such as shields for the slag hole and shields suspended over the workers while they are cleaning or repairing the inside of the cupola—can also do much to reduce the volume of accidents arising from cupola operations.

Crucible furnace operators do not have the great volume of heavy materials to handle as is the case in cupola operations. However, they are exposed to intense heat radiations when removing the crucible or whenever the cover is off while the furnace is lighted, and they are faced with the danger of burns from the molten metal and of eye injuries from light radiations or from spattering metal. Heavy clothing and goggles are essential equipment.

Reverberatory furnace workers are exposed to intense heat during slagging, sampling and tapping operations, and frequently experience burns and eye injuries from spattering metal. They are also exposed to all the hazards of crane operations while charging their furnaces. Safety shoes, goggles, and heavy clothing are generally considered essential for the protection of these workers.

The electric furnaces used in foundries may be either of the electric arc type or the induction type. Arc furnaces, which are the more common type used, vary widely in design. In some furnaces the roof is arranged so that it may be swung aside to permit access to the interior. Generally these furnaces are charged by hand and the molten metal is removed by tilting the entire furnace upon its trunions. Slagging is done by hand with a skimming bar, and the charge frequently must be rearranged during the melting process by pushing and poking with a heavy metal bar. In many instances the charge is partially melted in other furnaces before being introduced into the electric furnace.

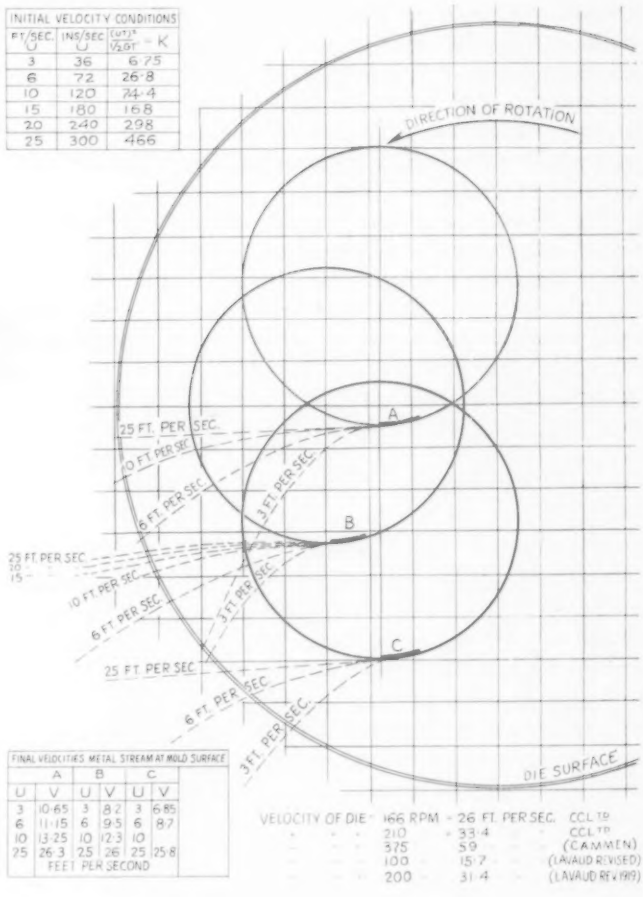
Electric furnace operators are exposed to the hazards of handling heavy, rough, and sharp materials in charging; are faced with intense heat in slagging, rearranging or adding to the charge, and when taking samples of the melt in hand ladles; and are subject to injuries and burns from spilled or spattered metal in pouring. There is also some danger of shock or burns from contact with electrical circuits. Gloves, goggles, safety shoes, and heavy clothing are essential equipment.

The injury frequency rates for the melting departments studied in this survey were uniformly high, both actually and in comparison with the rates for other foundry departments. In the ferrous job foundry group the melting departments had an overall average of 68 disabling injuries per million employe-hours worked, which was exceeded only by the averages for cleaning, chipping, and finishing, general labor, and shakeout work. In the nonferrous job foundry group the melting departments' average frequency rate of 74.2 was the highest departmental rate recorded. Similarly the (*Please turn to page* 190)

CENTRIFUGAL Casting Speeds

This first of two articles from a paper presented at the annual meeting of the Institute of British Foundrymen discusses early developments in centrifugal casting and theoretical calculations of rotational speed.

By Dr. J. E. HURST
Sheepbridge Stokes Centrifugal Castings Co. Ltd.
Chesterfield, England

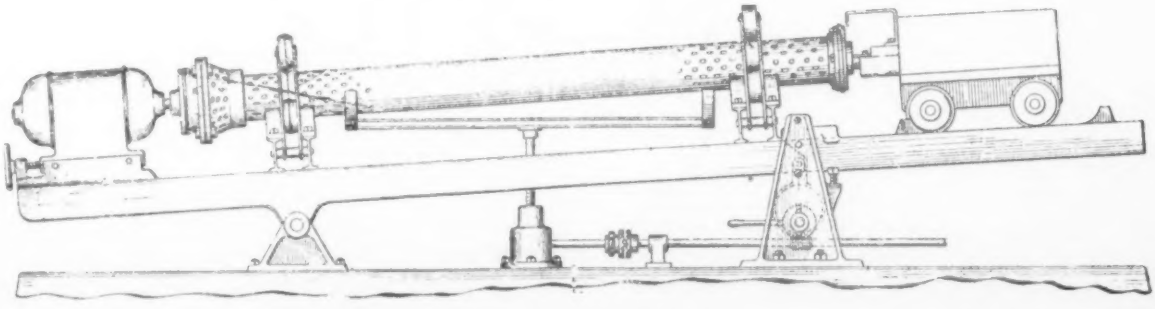

INITIAL VELOCITY CONDITIONS
FT/SEC. U | INS/SEC U | (UT)² / ½GT = K
3 | 36 | 6·75
6 | 72 | 26·8
10 | 120 | 74·4
15 | 180 | 168
20 | 240 | 298
25 | 300 | 466
DIRECTION OF ROTATION
25 FT. PER SEC.
20 FT. PER SEC.
15 FT. PER SEC.
10 FT. PER SEC.
6 FT. PER SEC.
3 FT. PER SEC.
A
B
C
DIE SURFACE
FINAL VELOCITIES METAL STREAM AT MOLD SURFACE
A | B | C
U | V | U | V | U | V
3 | 10·65 | 3 | 8·2 | 3 | 6·85
6 | 11·15 | 6 | 9·5 | 6 | 8·7
10 | 13·25 | 10 | 12·3 | 10 |
25 | 26·3 | 25 | 26 | 25 | 25·8
FEET PER SECOND
VELOCITY OF DIE 166 RPM = 26 FT. PER SEC. CCL TP
210 = 33·4 CCL TP
375 59 (CAMMEN)
100 15·7 (LAVAUD REVISED)
200 31·4 (LAVAUD REVISED)

IT IS probably true to say of each individual centrifugal casting process in commercial operation that the rotational speed or range of speeds adopted have been determined experimentally, having regard to the particular requirements of the process. The records of the work done in this field during the nineteenth century are to be found mostly in the patent journals, and the first direction as to speed of rotation appears to be that in the Provisional Specification[1] No. 1968, dated Aug. 23, 1856, and relates to a process which would be classified as true centrifugal casting, producing tubes and hollow axles as steel castings (also steel wheels). This patent application in the name of a French foundry of Jackson Bros., Petin Gaudet & Co., directs that the molds during the time of filling or running into them the molten metal should revolve at speeds of 500 to 1000 revolutions per minute.

The earliest patent in connection with the centrifugal casting process dated 1809 in the name of Eckhard[2] gives no directions as to speed of rotation, but speeds of a similar order of magnitude to the 1856 patent are to be found in several other British patent applications during this period. An interesting reference to speed of rotation is to be found in the British Patent No. 28144 of 1902 in the name of a Belgian Comte Paul de Hemptinne.[3]

In this invention, the mold is required to be rotated without vibration at a very high speed of 750 to 1000 revolutions per minute about the horizontal axis. It is stated that "it is well known that in order to obtain a suitable density or compactness of liquid steel projected upon the walls of the inside of the mold, it is necessary to apply to the said metal a tangential force equivalent to about sixty times its own weight; that is to say, in order to obtain a layer of metal of a thickness of 15 millimeters within a mold whose internal diameter is 160 millimeters it is

Fig. 1 (above)—Pouring positions and velocity curves for 36-inch outside diameter pipe. Fig. 2 (below)—Early design of centrifugal casting machine



necessary to impart a rotary movement to the said mold at the rate of 600 revolutions per minute." This is approximately equal to a peripheral velocity of 1000 feet per minute. Peripheral velocities still higher than this, of the order of 3000 to 4000 feet per minute, were probably envisaged by Farnum in 1892[4] in his process for the casting of steel wheels and tires.

The description of the method of casting locomotive wheel centers at the Crewe works of the L.N.W.R. in 1882[5] illustrates a method in which the dry sand molds are mounted on rotating turntables, and the mold filled with metal rotated about its vertical axis. This process might be claimed as an early example of semi-centrifugal or profiled centrifugal casting. It was claimed that rotation of these molds at speeds as low as 40 to 50 revolutions per minute assisted a good deal in the production of "sound clean castings."

Practice High Speed Rotation

It is evident from these early records that substantially high speeds of rotation were found necessary of the order of 500 to 1000 revolutions per minute. The processes described by these early workers all fall within the classification of true centrifugal casting, and it would appear that the notion of the importance of speed had developed into the form of a practical quantitative recommendation that the tangential force should be of the order of 60 times the weight of the metal. Where the calculation is possible, it is evident that rotational velocities within the range of 1000 to 3000 feet per minute were used.

Before considering the speeds adopted in the variety of modern processes, it is helpful to remember that the rotational velocity of the mold assists in the acceleration of the molten metal, and changing its direction of motion to that of the mold cavity. This function of rotational velocity is of prime importance in many of the processes of casting.

When molten metal is poured on the surface of a rotating mold, rotational velocity is imparted to it by virtue of the friction between the liquid metal and the mold, the internal friction between the layers of metal and also by virtue of the initial velocity of the stream of molten metal itself. In the rotation of liquid metals to produce castings (true centrifugal castings) in view of the shortness of time in which the molten metal can be maintained, and its constantly increasing viscosity during solidification, it is essential that rotational velocity shall be acquired in the shortest possible time. In many processes and many types of casting the even distribution of the liquid metal is dependent upon the amount of time available whilst the metal is still liquid and under the influence of the forces due to its rotational velocity.

The forces which induce rotation in molten metal introduced into a rotating container are tangential forces arising out of several conditions. The friction between the rotating container and the molten metal surface in actual contact with the container, and the internal friction or viscosity of the liquid metal, are two of the conditions which give rise to these tangential forces. The magnitude of the force due to friction between liquid and solid surfaces varies as the square of the velocity of movement and directly as the area of the "wetted" surface. In the case of molten metals which do not exactly "wet" the surfaces, it is possible that the magnitude of these forces is not large, and they may be considered to increase as the square of the velocity and the area of contact between the liquid metal and the container.

Surface Condition Exerts Influences

The condition of the surface of the container or mold will exert an influence in this direction also, and practical experiment provides ample evidence of such influence. The device of roughening the surface of the mold referred to in some patent specifications, e.g., Chester Clark[6], is probably designed to increase this surface friction.

The acceleration of the liquid metal is influenced also by the forces due to the viscosity of the liquid. In the case of alloy metals, the viscosity of the liquid metal cooling down to the solidification point increases rapidly and this effect is probably of great importance in determining the rapid acceleration of molten metals in commercial centrifugal casting processes. Abundant evidence of this is encountered in practice. In the production of castings of substantial radial wall thickness by rotation about the horizontal axis, where considerable time is necessary for the complete solidification of the (*Please turn to Page* 210)

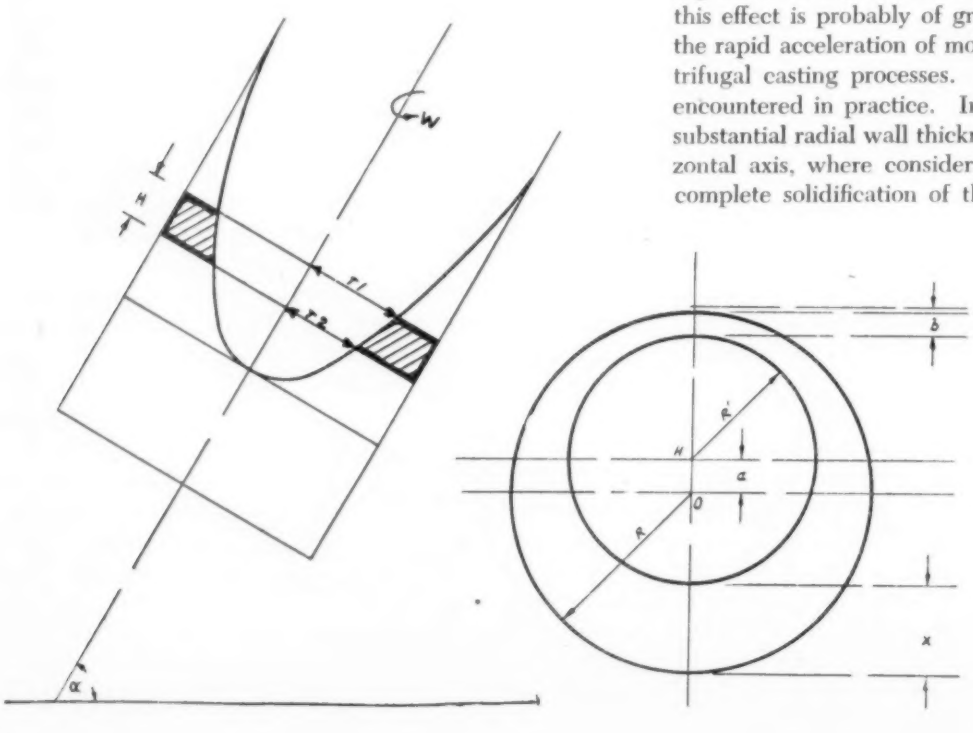


Fig. 3 (*far left*)—*Rotation about the vertical and inclined axis. Fig.* 4 (*left*)—*Rotation about the horizontal axis*

Boron in Malleable Iron

By NORMAN F. TISDALE
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UNTIL a year ago American malleable iron as a war material was in the category of neglected things. But accelerated war production and increased use of malleable iron brought the realization that the capacity of the industry was below the tonnage required for war. To correct that condition, the government provided manpower priorities and urged special consideration of means and methods for increased production.

One obvious approach to the problem of increasing malleable production is the reduction of the annealing time. Another concerns reduction in the number of re-anneals.

From certain effects that previously had been observed, it seemed that important aid might be found in additions of boron, and further experiments have verified that thesis. A rather extensive study of the subject has shown that boron, when properly used, results in a reduction in the annealing time, and also lessens the need of re-annealing.

Because of different methods of producing malleable iron and the requirement of obtaining sufficient uniformity in results, it is necessary to study carefully how boron might be incorporated into the metal. Plant conditions must be studied, charges examined, and foundry practice taken fully into consideration before this application may be successfully utilized in a given case.

The Molybdenum Corp. of America has been working for some years to extend the metallurgical knowledge of boron and has developed a very soluble ferroboron which goes into solution readily at casting temperatures. One of the investigations undertaken was on malleable iron and its susceptibility to effects of boron.

Low Percentage Approved in Practice

It may be recalled that earlier, when the author first advocated using 0.003 per cent boron in steel, a number of metallurgists openly expressed the opinion that this was beyond the realm of possibility. That low percentage, however, has been approved in practice. While working with malleable iron later on, advantage was taken of the earlier experiences with steel and the experiments were started with the addition of 0.001 per cent boron. Percentages of 0.001 to 0.003 were found to give best results.

It readily can be seen that where a foundry catches its iron in small shank ladles direct from the furnace, it would be almost impossible to get consistent results with such very small amounts of boron, namely 0.001 to 0.003 per cent, when added to the ladle. When pouring is done by shank ladle it is quite possible to inoculate the furnace completely with ferroboron by adding it direct to the air furnace. To do this, it usually is desirable to clear several spots of slag from the surface of the molten metal and to add the ferroboron about one-half hour before the tap. The flame should be shut off for a few moments, otherwise some alloy might be lost by the sweep of gases.

Since most air furnaces have a very shallow depth of metal, it is desirable to rabble the bath with rods to assure even distribution of the boron.

In the case of cupola iron, successful application has been made by adding the boron to the charge. This method is more expensive and not nearly so accurate as adding directly to the stream. In the case of duplexing metal, several companies have adopted an automatic method of adding weighted increments of the ferroboron to the stream leaving the cupola, and at such frequent intervals that they are insured of uniform results. In cases where the iron is melted entirely by electric furnace, the ferroboron may be added either to the furnace directly or to the ladles, provided the latter are large enough.

In foundries where bull ladles are used in excess of 100 pounds capacity, it will be found to be a simple matter to add the required amount of boron to each ladle. This procedure is handled more easily as the size of the bull ladle increases. It is desirable to add the ferroboron when there is some liquid metal already in the ladle, about a quarter ladleful being a good amount to allow. Most foundries add to ladles since it gives them more flexibility of control.

Within the usual range of 0.001 to 0.003 per cent, the amount of boron carried in malleable iron varies. This depends largely on scrap conditions where varying amounts of chromium may be encountered, on the type of melting used and on the final analysis of the malleable iron.

Those undertaking the research work early agreed with Dr. Schwartz, National Malleable & Steel Casting Co., Cleveland, that boron should be used in malleable iron mainly as a safety-first agent to insure proper annealing in the presence of undesirable amounts of chromium. After examining a number of samples of malleable iron, both with boron and without, it was apparent that in the boron-treated iron structure the graphite always was finer and more evenly distributed. This (*Please turn to page* 222)

Manganese Bronze Propellers

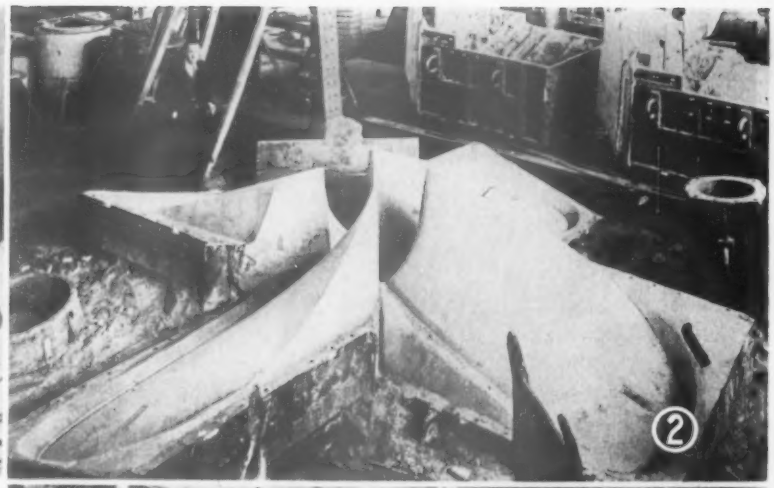
A PROPELLER is the tail end of a ship, a relatively small item in comparison with the bulk of the structure and with the thousands of other items of equipment. Without a propeller, a ship representing millions of dollars in investment and perfect in every detail, would be as useless and helpless as a decoy duck floating in a mill pond. A propeller is perhaps the most perfect exemplification of the well-known paradoxical saying "The tail wags the dog!"

The propeller of a Liberty ship, approximate weight 10 tons and 18½ feet in diameter, revolves 75 times per minute, or one and one-half complete revolutions every second, at the end of a shaft actuated by a triple-expansion, vertical type engine developing 2500 horsepower. The tip of each of the four blades circles through the water at a speed of 50 miles per hour while imparting headway to the vessel. The unit must be nicely balanced so that each blade strikes the water a blow corresponding exactly to that dealt by each of the other blades.

Making propellers for all types of ships and under all sorts of war conditions, is a highly specialized job which has helped to keep the Cramp Brass & Iron Foundries Division of Baldwin Locomotive Works, Eddystone Pa., 100 per cent in the war effort with orders from the Navy and the U. S. Maritime Commission. Since Dec. 7, 1941 and up to September, 1944 the foundry has turned out 145,176,039 pounds, or 72,588 tons of castings, mostly a manganese bronze alloy that involves a high degree of precision in melting, pouring, molding and finishing. Melting capacity of the large brass foundry is 3,000,000 pounds per month, while that of the small foundry is 500,000 pounds per month on a wide miscellany of castings ranging in weight from half an ounce to 20 tons.

Before the Pearl Harbor date, the average propeller output of the foundry was 13 per month. Since then the average output is 125 per month, with approximately 95 per cent for Maritime Commission ships. Most of the remainder have been for United States battleships, battle cruisers, light cruisers, aircraft carriers, destroyers, destroyer escorts, destroyer tenders, submarines and submarine tenders and seaplane tenders. A large number of propellers have been made for coast guard cutters.

Majority of the propellers have been confined to two types, 18½ feet diameter for the Liberty ships and 20½ feet diameter for the Victory ships. In the rough these castings weigh respectively 22,000 and 54,000 pounds. The pattern for each is an unfinished bronze casting which, if ground and polished, could serve as a working propeller



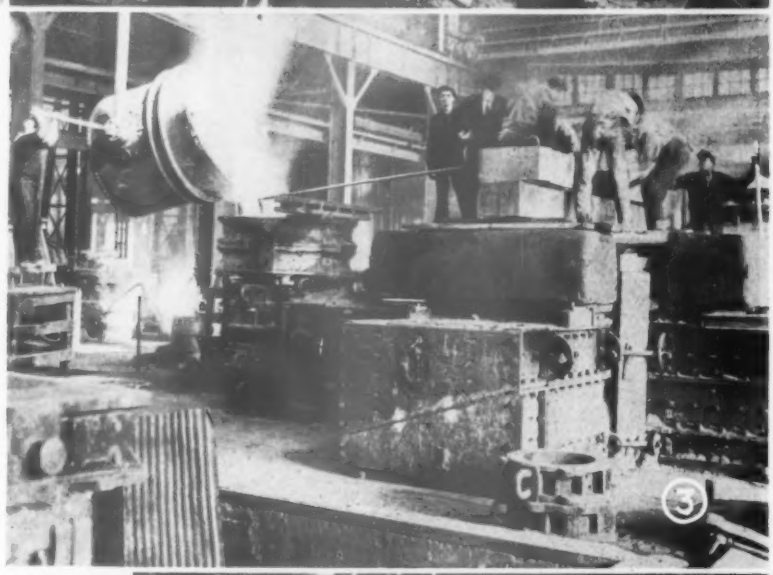
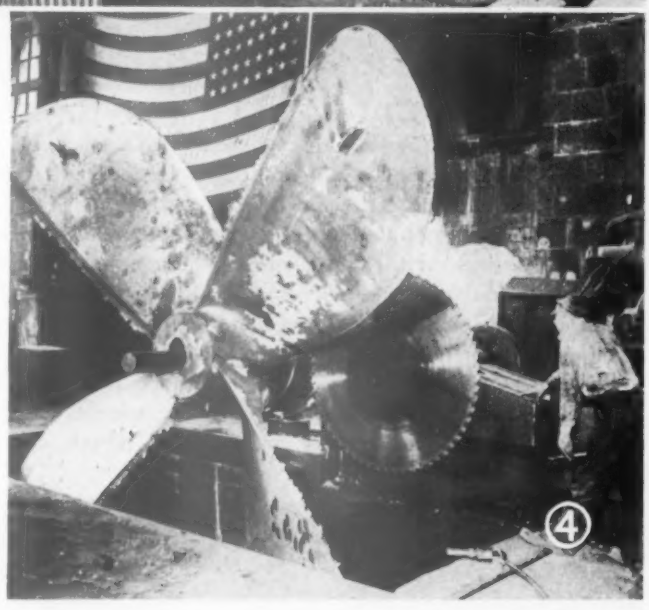


Fig. 1—Flask for propeller mold consists of four units arranged in shape of a cross. Joint lines correspond approximately to shape of blades

Fig. 2—Showing drag after copes and pattern have been removed. Slots near blade tips form coupons which later are removed for testing

Fig. 3—Metal first is poured into large basin adjoining mold and when filled enters mold at bottom of hub through sprue made up of tiles

Fig. 4—Circular saw cutting sinkhead from casting. Later machining includes grinding and polishing blades, followed by accurate balancing



on a vessel. All dimensions are larger than those on the casting to be produced. Excess allows for the natural shrinkage between metal in the molten and in the solid state. The large mass of the rough casting, or pattern, also provides for any minor warpage, and provides extra metal required in the machining and finishing operations on a wheel which must meet very close dimensions and tolerances. The accompanying illustrations show progressive steps in the molding of a large propeller in the foundry of the Cramp Brass & Iron Foundries Division.

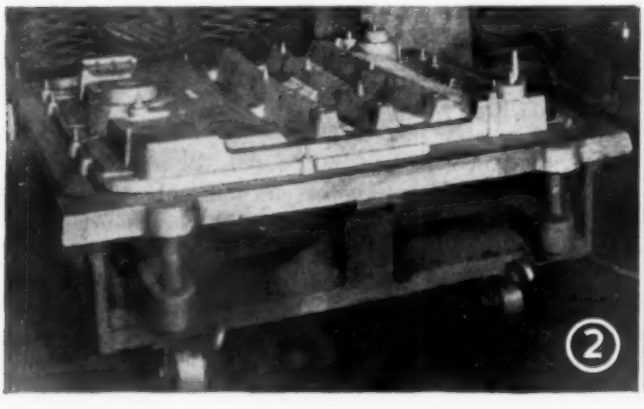
Fig. 1—The propeller mold is made in a special flask of four units arranged on the floor in the shape of a cross and with the joint lines corresponding approximately to the shape of the blades. The metal pattern to be used later in production is made in one of the flasks from a wood pattern consisting of a quarter hub and one blade. After the mold for one blade is made the wood pattern is lifted out, swung around 90 degrees and lowered into the second drag. The process is repeated for the remaining two blades. The resulting casting is chipped and cleaned and serves thereafter as a pattern for succeeding molds. The sand in these molds is bonded with cement which sets practically as hard and rigid as stone. After the molds are blackwashed and closed a pipe is inserted in the hub and hot air is driven into the mold for about 12 hours.

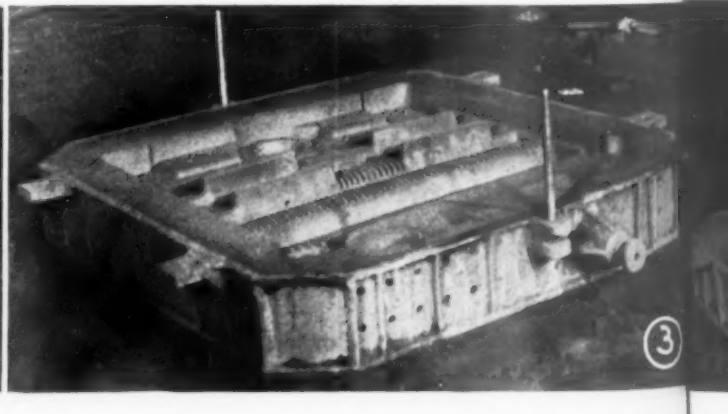
Fig. 2—The drag is shown as it appears after the copes and the pattern have been removed. The small rectangular slot near the tip of each blade forms the test coupon which later is removed and taken to the laboratory where it is tested for chemical and physical properties. Manganese bronze for propellers conforms to the following specifications: Copper 58 per cent; zinc 39 per cent; iron, aluminum and manganese 1 per cent each. This metal shows tensile strength of (*Please turn to page* 228)

Fig. 1—With the assistance of crane and magnet one man loads the buckets and charges the cupola

TWENTY-FIVE years ago in Fremont, O., the Lincoln Stove & Range Co., went out of business after a somewhat checkered career. About the same time Charlie Miller, superintendent of a furnace foundry in Medina, O., decided that his chance of filling the family barrel with doubloons and Pieces of Eight would be better as a proprietor than as a hired hand. Here was a fine, substantial brick building 800 feet in length and 80 feet in width conveniently empty and ready for occupancy. He modestly estimated that with his training, experience, general knowledge of the foundry industry and the characteristic faith and optimism of a man accustomed to stand on his own feet for many years, he could operate a foundry and keep his records in black instead of in red ink.

Friends and acquaintances, practically without exception, gravely assured him he was making a serious mistake in giving up his position as foundry superintendent in another town. Most certainly he would lose his shirt in the contemplated venture. Ever the perfect gentleman, Charlie listened politely to the eagerly offered advice of one and all. In the foundry vernacular he allowed the advice to dribble in through one ear and out through his left elbow. Then he went ahead with his plans, opened the foundry, filled it with men and machines, and what is more important, secured long running contracts for castings that eventually necessitated the melting of 120 tons of iron per day. Under present conditions, with distressing shortage of foundry labor, the daily heat has been reduced to a considerable extent. The shop crew, as in practically all Midwest foundries, includes young and middle-age men of many nationalities,





trained in a comparatively short time to become swift and skillful operators. With the exception of three or four girls in the office, no women are employed in the plant.

A final word about this modern captain of industry, then we shall leave him in the control tower where he pulls the strings and pushes the buttons which keep the business running as smoothly as a $40 watch or, perhaps more appropriately, as one of the various mechanical devices for which he makes the castings.

At the age of 11, when of course he should have been in school, if he ever intended to amount to anything, he got himself a job in the core room of the old National Malleable & Steel Castings Co. plant in Cleveland, at that time presided over by the famous and widely known superintendent Jack Carroll. Jack took a liking to the energetic young lad, big and strong beyond his years, and taught him the trade in a thorough manner. Later as a journeyman he worked in other foundries and for a period of 14 years was superintendent of a shop in Medina. He was not an amateur when he started in business under the title Fremont Foundry Co., Chas. Miller, Prop. Intimate knowledge of every detail involved in the production of castings has been an important factor in maintaining harmonious relations between management and labor.

In addition to the main foundry building, the plant includes several other buildings devoted to various purposes. One is the cleaning and shipping department, while another houses the activities of a number of men engaged in a side line, the manufacture of aluminum and magnesium flasks and slip jackets of special design and construction.

With several partitions between, the east end of the main building contains the office, pattern shop, electrical repair and maintenance shop, stores and supply department and the compressor room, where three machines, two active and one spare, supply air to the long lines of molding machines, the remainder of the building, with the exception of a space approximately 40 x 200 feet for the core room, is devoted to the production of molds for a wide variety of castings ranging in weight from a fraction of a pound to 400 or 500 pounds. The large molds

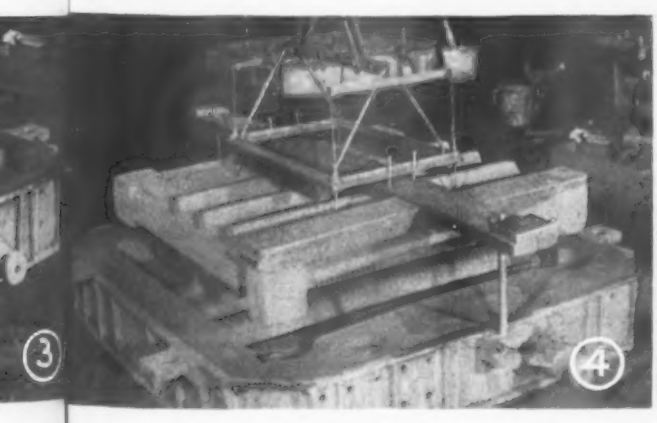
...IG SHOP *In Small Town*

By PAT DWYER
Associate Editor
THE FOUNDRY

are made under a sandslinger. The others are made on various types of molding machines stationed close to the wall on either side of the building. In several instances the molds are large enough to require the services of two men, but in the majority of instances the machine is operated by a single molder.

Molding floors extend from the walls to a central gangway, 12 feet wide, extending from one end of the building to the opposite end. The gangway and floor on either side, smooth and level concrete, facilitate transport of materials and also facilitate the work of keeping the shop clean and orderly. In the morning the molder lays down a piece of string across the front of his floor. The string is attached to a small weight at either end and serves as a guide in setting down the first row of molds along the edge of the gangway. The following molds are set down behind the first row in straight and parallel lines until the floor is filled from the gangway back to the molding machine. This arrangement involves a minimum amount of manipulation on the part of the man pouring metal from a bull ladle suspended from a crane.

A line of steel columns erected in the center of the gangway, each column topped by a cross bar, supports two monorails. Auxiliary support is furnished by vertical rods attached to the roof beams. Branch lines lead to two cupolas at one side of the building and approximately the



Figs. 2 to 5 — Successive stages in production of boiler section mold. Fig. 2 — Showing pattern and pattern plate, also arrangement of runner and gates. Fig. 3 — Drag mold resting on sand bed on the floor Fig. 4 — Balancing jig is employed to set core in mold. Fig. 5 — Channels in sand bed assist escape of gas and steam

same distance from either end. Molten metal from the cupola flows down the spout into a tilting spout which delivers the metal alternately into a 1000-pound capacity bull ladle at each side. The filled ladles suspended from the monorail are pushed to any designated point on the central gangway where the metal is poured into 300-pound capacity bull ladles equipped with lever and ratchet hoists and suspended from cranes which span the entire floor area.

The molds are shaken out by a night gang. Castings are hooked out of the sand and loaded into steel tote boxes mounted on skids. Lift trucks carry the loads to the cleaning department, an adjoining and parallel building 50 x 500 feet. The sand is wet down and cut over by two rotary type machines for which electric current is furnished by a long cable with one end attached to a reel, and the other end plugged into a number of sockets in succession on the central row of columns. The sand cutters go over the sand once or twice, depending on the amount of preparation necessary. Obviously, heavier castings dry the sand to a greater extent than light castings. More time and more water are required in the first case than in the second, to restore the sand to a workable condition. In the final movement of the sand cutter the sand is kicked back and up into a heap in the vicinity of the molding machine.

Facing sand is prepared in two pieces of equipment set up near one end of the foundry. Although different in construction and method of operation, each machine discharges the prepared sand in a fluffy stream into a large pile at the back from which it is taken by wheelbarrow to the vicinity of the various molding machines. Sea coal incorporated in the mixture produces a clean smooth skin on the castings and—among other features—reduces the amount of work in the cleaning room. Amount of sea coal varies from 6 to 10 per cent, depending on the size, weight and section thickness of the casting.

Most of the molds are made in snap flasks, but a considerable number, for various reasons, are made in the cope and drag flasks that remain in place until after the molds have been filled with metal. These flasks are equipped with tapered lugs on the sides upon which box clamps are tightened by a tap or two of a hammer. The clamps are readily knocked off and retrieved by members of the shakeout gang. There are no wood wedges to be burned or broken or to remain in and contaminate the sand.

One section of the floor area is devoted to the production of boiler section castings. A cope pattern and a drag pattern are mounted within a few feet of each other and in front of a sandslinger. Cope and drag flasks in rotation are packed full of sand, then lifted away by an air hoist and set down on the floor. One operator manipulates the sandslinger while other men attend to setting the flasks in place over the pattern, lifting them off, clearing vents and sprues, placing the drags on the (*Please turn to Page* 240)

Fig. 6—Coke for the cupola bed is set on fire from a gas flame out in the yard. The container is equipped with a drop bottom and a cone shaped grate. When the coke is burning briskly the crane man lowers the load into the cupola, trips the bottom and removes the container. Fig. 7—Long rows of small molds are poured from ladles attached to mechanical hoists and suspended from monorails. Fig. 8—Light cranes extend from the center of the shop to the side walls

Properties of Refractories

This article is from a paper presented at the eighth annual Foundry Conference held in Milwaukee by the Wisconsin Chapter, A.F.A., and the University of Wisconsin

By J. A. KAYSER
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Laclede Christy Clay Products Co.
St. Louis

THE term, refractory, as applied to industrial products, normally is taken to mean "resistant to high temperatures." The term usually implies a product suitable for lining industrial furnaces in which either combustion alone or some process requiring high temperatures takes place, and it is well known that resistance to high temperatures is a necessary, but not a sufficient requirement, in a refractory.

In almost all industrial furnaces the action of heat is combined with chemical reactions of some type or another, and we have what the refractory engineer with a broad term calls *slag action*. In addition, temperatures are not constant, which gives the added problem of temperature fluctuations. Finally, some strictly mechanical action may be taking place in the furnace, and this will add to the destructive forces to which the refractory lining is exposed—that of abrasion. So it becomes evident that the term, refractory, from an industrial standpoint comes to mean a product which will resist some or all of these destructive actions, and therefore, will be suitable for lining industrial furnaces.

The more important refractory products being used in industry today fall within the following classes:

1. Silica-alumina refractories, which include fire clay refractories, high alumina refractories, and sillimanite or kyanite refractories.
2. Acid refractories as represented by silica refractories.
3. Basic refractories as represented by magnesite refractories.
4. Neutral refractories as represented by chrome refractories.

All four types have some advantages and some disadvantages. Fire clay refractories, for example, will withstand temperature fluctuations better than any of the others. Silica will carry load at high temperatures and will resist acid slags. Chrome and magnesite refractories are much more refractory than fireclay, and silica will resist basic slags much better but has low resistance to spalling and low load bearing capacity at high temperatures. The table on the next page gives the approximate composition, pyrometric cone equivalent (P.C.E.), cold strength, and weight per cubic foot of the standard brick in these classes of refractories.

Manufacturing Methods Affect Product

Before discussing in greater detail the properties of the various types of refractories, let us briefly consider the methods of manufacture which necessarily have some bearing on the properties, and which, in some measure, explain the shortcomings and the advantages of them.

One of the fundamental differences in manufacture between refractories and metals is that little or no refining of raw materials takes place in the refractories industry. In general, it is necessary to use the raw materials as they are found in nature, the only treatments possible being calcination and grinding. By varying the degree of calcining, and by careful grain sizing, properties of a refractory can be varied within certain limits, but in comparison with what can be accomplished through refining methods in the metallurgical industries, the variation and final results in the refractories industry are very small indeed.

In the case of fireclay refractories the clays are mined in the immediate vicinity of the manufacturing plants. Various types of clays are used, the chief variation being in plasticity. Thus we have what is known as bond or plastic clays, semi-flint or semi-plastic clays, and flint clays which are almost nonplastic. Some clays are calcined either in rotary kilns or by being made into dobies and calcined in brick kilns. The clays are ground and screened, usually by the use of a dry pan and vibrating wire screens —a process that seems rather crude, but actually is the most suitable one for obtaining the grain sizes required in the manufacture of fire brick.

Up to this point the process is the same, regardless of what kind of firebrick is to be manufactured. However, in the further processing, three different methods may be employed in the forming of the brick; these include dry press (sometimes called power press), stiff mud, and soft mud methods.

In the dry press process only a little water is added to the mixture of ground clays, and the almost dry powder is formed under high pressure by heavy mechanical presses. In the stiff mud process a greater quantity of water is added—enough to produce, as the name implies, a stiff mud. Water is added to the clay mixture in a pug mill, and the mud is extruded through an auger machine, usually with a vacuum attachment to remove as much air as possible and form a dense and pliable column. The clay column is cut by wires to form blanks which are repressed into the desired shape.

For the soft mud process which has to be used for many

special shapes, a still greater quantity of water is added to the clay grog mixture to form a soft mud which can be shaped by hand and by being thrown into wooden molds. The brick or shapes formed by either method are dried and burned in periodic kilns, or now mostly in continuous tunnel kilns.

Raw clays shrink in burning, and therefore the brick have to be made oversize when they are pressed. The amount of shrinkage varies with the properties of the bond clays and the amount of calcined clays used in the batch, as well as with the amount of water used in the process. Therefore, shrinkage has to be determined carefully for each batch and shrinkage rules used in making molds and dies.

With the raw materials available in the various producing districts, the properties of the finished product can be varied only in the following ways: Variation in proportion of calcined and raw clays; variation in grain sizes; variation in manufacturing process (dry press, stiff mud, or soft mud), and variation in burning temperature.

These variations do not change the chemical composition of the clays nor the fusion point, but they do influence the resistance to slags, the resistance to spalling, and the resistance to abrasion. Thus, a brick low in calcined clay, fine grained, made by the stiff mud process and burned at high temperature will have great density and strength, and therefore, be resistant to slag action and abrasion.

Such a brick would be suitable for malleable furnace side walls, for example, but would not be desirable in a gas or oil fired heating furnace because of its low resistance to temperature fluctuations. On the other hand, a brick with a higher proportion of calcined clay, larger grain size, and made by the dry press process, would have a more open structure and be more resistant to temperature fluctuations.

Thus it is entirely possible to produce two brick of identical chemical composition with identical fusion point, but still sufficiently different to make it necessary to choose carefully the one best suited for a particular application. That is one reason why specifications covering firebrick frequently do more harm than good, and why the manufacturer often can be of greater assistance to the user by recommending the brick best suited for the purpose.

Silica brick are made from silica ganister or quartzite found in Pennsylvania, Wisconsin, Alabama, and Colorado. The ganister is crushed and ground, treated in a wet pan with about 2 per cent milk of lime. The comparatively nonplastic mix is thrown into molds similar to the soft mud process for fire clay brick. Standard silica brick are being made in a drop machine or on mechanical presses. The brick are dried in tunnel driers and fired either in periodic kilns or in continuous tunnel kilns. The lime bonds fired brick sufficiently for handling, and in burning it reacts with the silica to form a strong ceramic bond. Silica brick do not shrink in firing, but have a permanent linear expansion of about 3.5 per cent due to crystalline changes of quartz to tridymite and cristobalite. Quartzite has a specific gravity of 2.65, tridymite of 2.26, and cristobalite of 2.32, and therefore, the volume must increase during the burning process.

Material Burned at High Temperature

In magnesite refractories the raw material is magnesium carbonate (magnesite) which is first "dead burned" at very high temperatures. This burning process produces periclase of crystalline MgO which is used in the manufacture of magnesite brick.

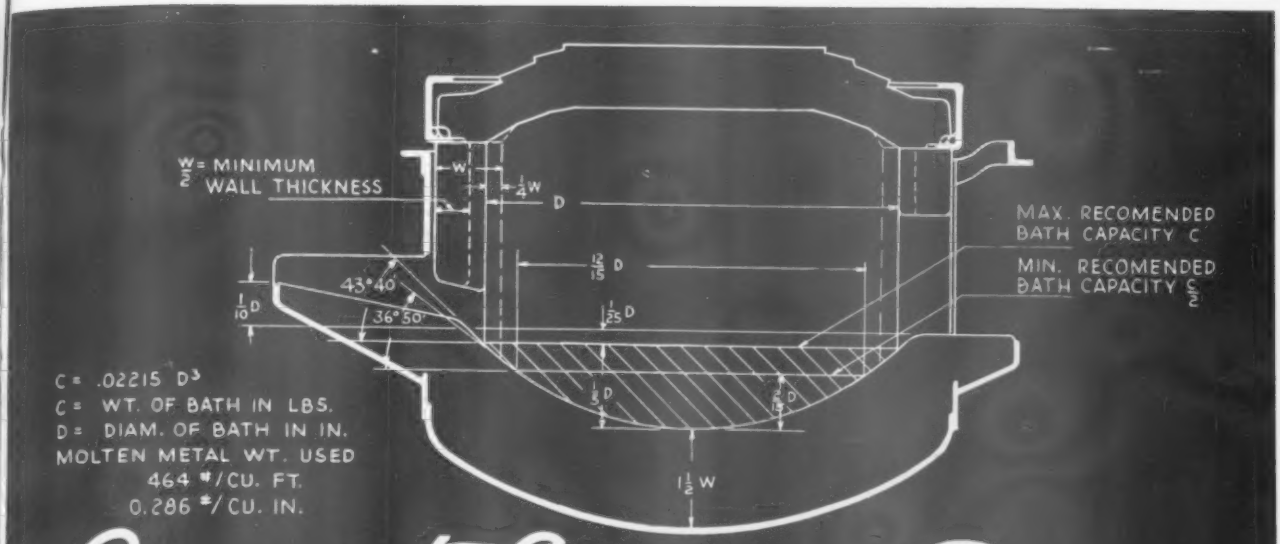
Raw material for chrome refractories is chrome ore, a solid solution of several minerals of the spinel group. Chromite, $FeCr_2O_3$, is one of these, but there are always others present. MgO, Al_2O_3, and other spinels are very frequently found with chromite. Commercial chrome ore therefore, is far from pure chrome oxide, but contains from 35 to 60 per cent Cr_2O_3.

Fosterite ($2MgO$, SiO_2) refractories are made from olivine rock ($2RO$, SiO_2) by adding magnesia. Fosterite contains 57 per cent magnesia and 43 per cent silica.

The manufacturing process is the same for all the brick in the chrome-magnesite group. Three types of brick are produced, and include brick bonded by firing, chemically bonded brick and metal case brick. In the first process the raw materials are ground and blended with careful consideration to grain size, tempered with water in a wet pan and molded at extreme pressures in hydraulic or mechanical presses. The brick are dried in tunnel driers and burned in periodic or continuous kilns at considerably higher temperatures than those used for silica and fireclay brick. Chemically bonded brick are made by adding a chemical binder in the grinding process. The dry press are very strong, and frequently have properties supe- (*Please turn to page* 224)

PROPERTIES OF COMMON REFRACTORIES

	Description	Composition	P.C.E.	Cold crushing strength P.S.I.	Porosity	Weight per Cubic foot lbs.
Silica—alumina group	High heat duty Fire Clay Brick	52-60%SiO_2 34-42-Al_2O_3	31-33 3056-3173°F	1000-4000	12-24	125-140
	Super duty fire clay brick	48-52%SiO_2 42-46-Al_2O_3	33-34 3173-3200°F	1500-5000	12-16	130-140
	High alumina brick					
	50% alumina brick	43-48%SiO_2 47-52%Al_2O_3	34 3200°F	3000-5000	20-25	125-135
	60% alumina brick	33-38%SiO_2 57-62-Al_2O_3	36-37 3290-3308°F	3000-5000	22-30	130-140
	70% alumina brick	23-28%SiO_2 67-72%Al_2O_3	38 3335°F	2500-5000	24-34	135-145
	Kyanite, mullite or sillimanite brick	33-40%SiO_2 55-62%Al_2O_3	36 3290°F	3000-6000	20-28	135-145
Acid	Silica brick	95-96%SiO_2	31-32 3056-3092°F	2000-4000	22-30	100-112
Basic	Magnesite brick	83-93%M_xO 2-7%Fe_2O_3 5-10%RO	Above 38 Above 3335°F	3000-6000	20-28	160-180
Neutral	Chrome brick	30-35%Cr_2O_3 15-33%Al_2O_3 14-18%MgO 11-17%FeO 3-6%SiO_2	Above 38 Above 3335°F	3000-6000	20-28	180-190



Electric Furnace Capacity

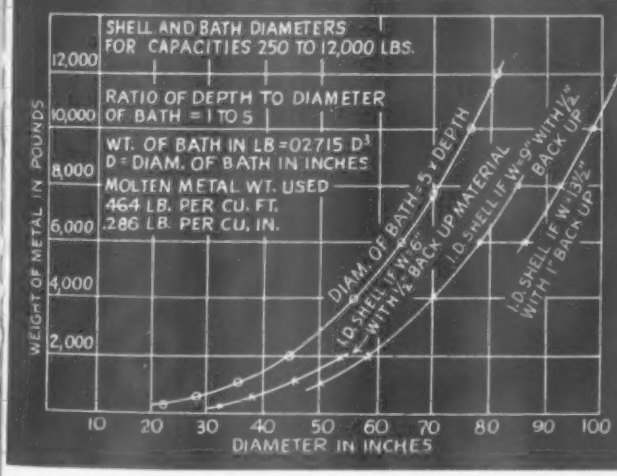
By JOHN McBROOM
Electric Furnace Engineer
Chicago

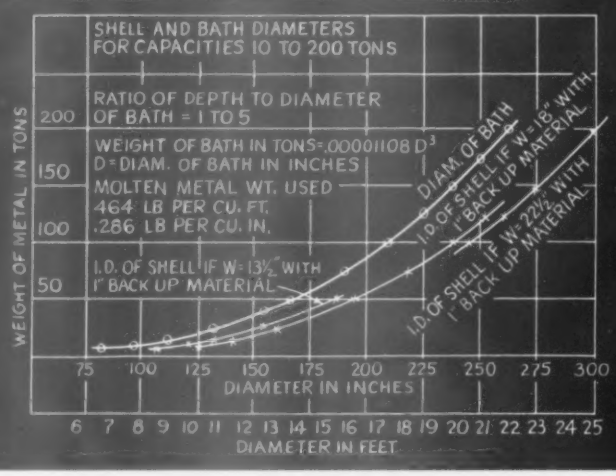
A GREAT deal of confusion exists among electric furnace operators and executives as to electric furnace capacities. This article describes briefly a method which the author has developed to determine the size shell for any size heat. It may not be the best method, but it works, and in the absence of any other available data it may be used. Suggestions and criticism by furnace men are earnestly solicited by the author.

In developing this shell capacity data, an effort was made to establish a recommended ratio of depth to diameter of bath. If the bath is too shallow for a given diameter, too much slag is required to cover a given amount of metal and the heat is difficult to handle. On the other hand, if the bath is too deep, it is difficult to melt metal on the bottom, patch the slag line corrosion properly, and drain the metal from the furnace when tapping.

Conclusions are all drawn from these purely mechanical considerations. For lack of authentic data, the interesting studies of effect of bath (*Please turn to page* 235)

Fig. 1 *(above)—Diagram of theoretical furnace shell. Proportions apply to most foundry furnaces. Fig.* 2 *(left below)—Chart showing diameter of bath with* 1/5 *depth to diameter ratio for any capacity from* 250 *to* 12,000 *pounds. Fig.* 3 *(right below)—Chart showing bath diameter for capacities of* 10 *to* 200 *tons*


SHELL AND BATH DIAMETERS FOR CAPACITIES 250 TO 12,000 LBS.
RATIO OF DEPTH TO DIAMETER OF BATH = 1 TO 5
WT. OF BATH IN LB = .02715 D³
D = DIAM. OF BATH IN INCHES
MOLTEN METAL WT. USED
464 LB. PER CU. FT.
.286 LB. PER CU. IN.
DIAM. OF BATH = 5 x DEPTH
I.D. SHELL IF W = 6" WITH ½" BACK UP MATERIAL
I.D. SHELL IF W = 9" WITH ½" BACK UP
I.D. SHELL IF W = 13½" WITH 1" BACK UP
WEIGHT OF METAL IN POUNDS
12,000
10,000
8,000
6,000
4,000
2,000
10 20 30 40 50 60 70 80 90 100
DIAMETER IN INCHES


SHELL AND BATH DIAMETERS FOR CAPACITIES 10 TO 200 TONS
RATIO OF DEPTH TO DIAMETER OF BATH = 1 TO 5
WEIGHT OF BATH IN TONS = .00001108 D³
D = DIAM. OF BATH IN INCHES
MOLTEN METAL WT. USED
464 LB PER CU. FT.
.286 LB PER CU. IN.
I.D. OF SHELL IF W = 13½" WITH 1" BACK UP MATERIAL
DIAM. OF BATH
I.D. OF SHELL IF W = 18" WITH 1" BACK UP MATERIAL
I.D. OF SHELL IF W = 22½" WITH 1" BACK UP MATERIAL
WEIGHT OF METAL IN TONS
200
150
100
50
75 100 125 150 175 200 225 250 275 300
DIAMETER IN INCHES
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
DIAMETER IN FEET

Improves ALUMINUM ALLOY Melting Procedure

NORMAL foundry production for the Robertshaw Thermostat Co., Scottdale, Pa., consists of aluminum and copper-base alloy castings used in its heat control devices, of which perhaps the best known are the commercial cooking regulators found in restaurant, hotel, or lunchroom steamtable equipment. The company has operated a nonferrous foundry in Youngwood and Scottdale, Pa., since 1899. A general view of the Scottdale foundry, looking toward the furnace section, is shown in Fig. 1. It was this long practical experience which led to one of the more difficult wartime production assignments involving aluminum alloys—an intricate oil pump body for one of the more highly specialized aircraft engines.

Some of the technical problems encountered in making a casting of this type will be of interest to foundrymen who face similar problems, where the castings include many thick and thin sections, intricate core work, and a heat-treatable aluminum alloy. This pump body possessed a previous record of rejections which elsewhere and in this particular foundry, seldom had gone below 50 per cent because of pinhole porosity, leakage under pressure, gas pockets, blows, suspended sand, and several other defects which are still widely controversial. The inspection procedure is exacting. If it were not for security reasons, it would be interesting to point out its specific importance, since certain high-altitude engines, wanted in quantity by our allies, could not be turned out without this oil relief valve body attached.

The fact is, the casting was a headache, and all methods of trial and error to isolate the main causes of failure were of no value until use of an electric induction furnace caused rejects to drop at once from 50 per cent to below 18 per cent before further refinements in gating were adopted to lower this still more. The actual figure on rejects today is 7 per cent maximum.

The alloy itself, long known to practical foundrymen as tricky under all conditions, is identified in England as the

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Robertshaw Thermostat Co.
Scottdale, Pa.

heat-treatable "Y" series. The industry has no similar name for it here. The most important elements in it are silicon, nickel, copper, titanium, manganese and iron. The practical ingot analysis and limits are as follows: Copper 1.30—1.70 per cent, nickel 0.75—1.00 per cent, manganese 0.08—0.20 per cent, iron 0.85—1.20 per cent, titanium 0.10—0.20 per cent, silicon 2.00—2.80 per cent, others 0.20 maximum, and aluminum remainder.

A finished pump body is shown in Fig. 2. Here may be seen contour outlines as well as the variety of openings required for the threaded connections and stainless steel insert sleeves. Aside from small drilled bolt holes on the mating face, there are seven of these main openings altogether, ranging from 1¾ to ⅝-inch diameter. Actual cross sections, showing thick and thin sections in the as-cast state may be seen in Fig. 3, taken at the author's desk. There are pronounced variations in mass and side-wall dimensions, but the average is from 0.150-inch in the thin sections to slightly over 1-inch. The core assembly is shown in Fig. 4 (dry sand mold), together with components disassembled for clarity of examination. Use of the new induction furnace required no change in this practice, and it is shown here merely as a fundamental part of the casting procedure. Certain changes were made in the pattern (Fig. 4, cope upper left, drag lower right), and most of these were in the cope portion. These changes will be touched upon in their proper order.

Albany green sand No. 1 is used for ramming the cope. Dry sand molds are made of Michigan City and Providence sands. Core oven practice is standardized for a

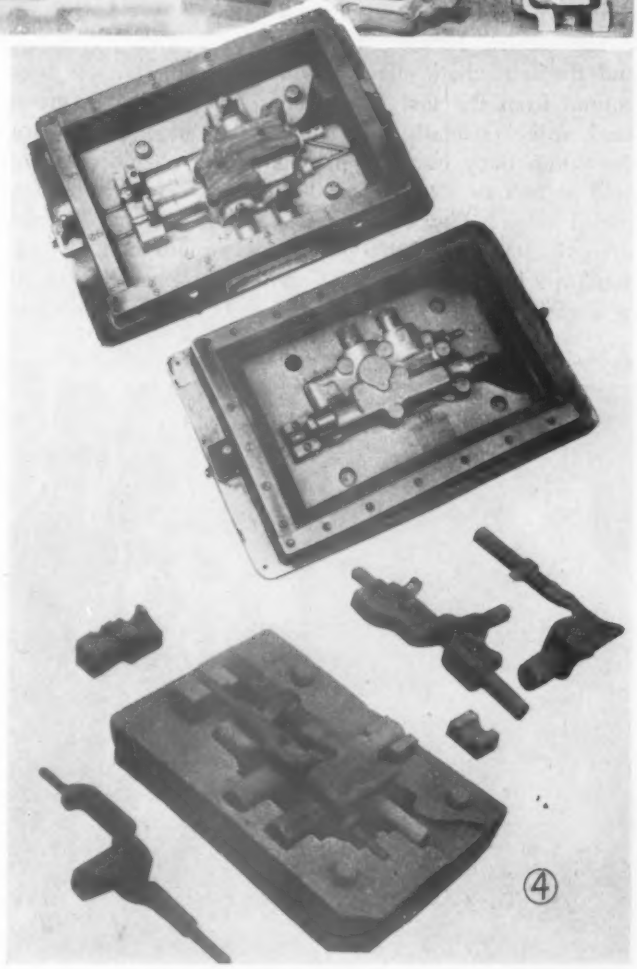
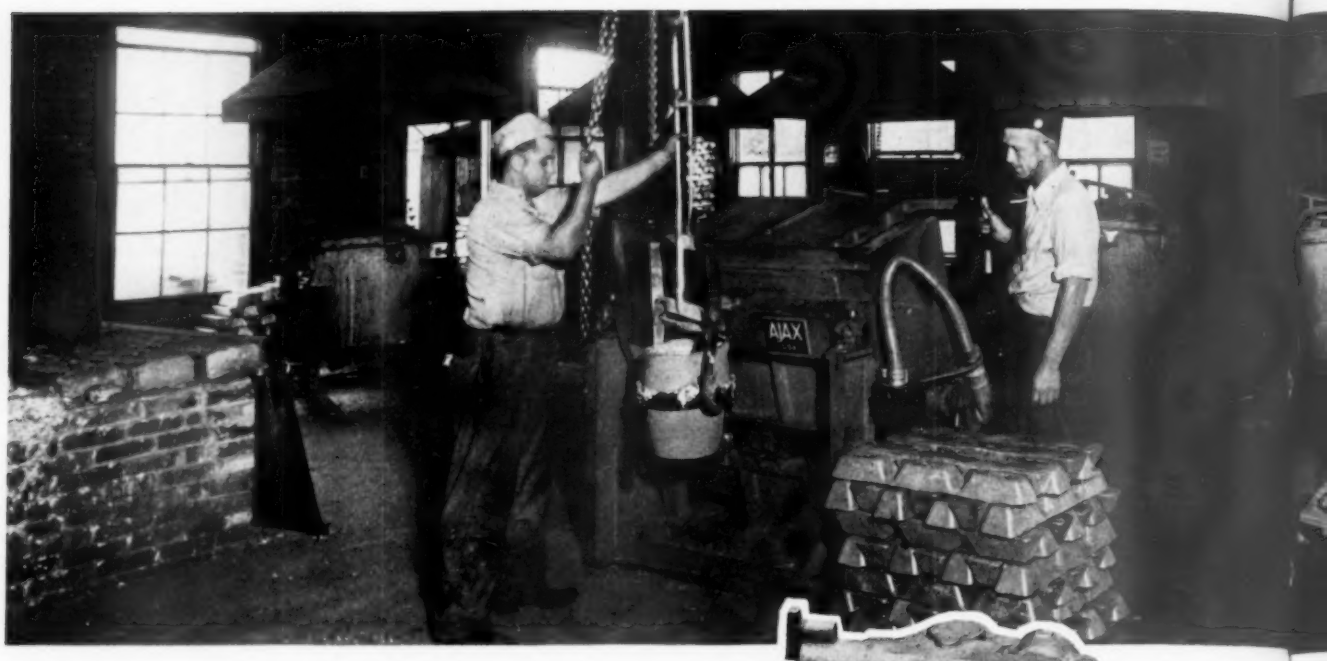


Fig. 1—General view of foundry division, Robertshaw Thermostat Co., Scottdale, Pa., looking toward the induction furnace section. Production flow is outward from furnaces toward machining section where gates and risers are removed. Fig. 2—Finished oil pressure release pump body made of heat treatable aluminum alloy. Fig. 3—The author shows cross sections of the casting illustrated in preceding figure. Thick and thin sections added to the problem of producing sound castings. Fig. 4—Pattern, cores and dry sand mold used in making the pump body. Pattern views show cope (upper left) and drag (lower right)



cereal type of binder and core oil.

The electric furnace was installed on Feb. 12, 1944, and the immediate effect was disclosed in the test bars poured from the first heat. These are poured in green sand, using no chills, and later heat treated, just as are the pump body castings, in a gas oven chamber, being held at 525 to 550 degrees Fahr. for 5 hours and then cooled in air. Physical properties called for are: Tensile strength 20,000 to 22,000 pounds per square inch; elongation (in 2 inches) 2.5 to 2.00, and a brinell hardness of 60 or slightly above. Aside from defects noted in previous

practice, a further proportion had been due to borderline physical properties of the test bars, which usually failed at 21,000 pounds per square inch and always showed debatable or unsatisfactory fracture, color, grain, or oxidized appearance. With the first heat poured from the induction furnace, this uncertainty was eliminated, average physicals now being around 26,000 pounds per square inch tensile strength, 3.2 per cent elongation, with the brinell up somewhat to between 60 and 65.

Customary charging practice previously had been to use 60 per cent new metal in the form of ingot, and 40 per cent backstock. Owing to the way return scrap had piled up, and to the presence of sand, oil, or mechanically-held dirt contamination, it had been the usual thing to melt backstock separately and to keep it available for making up charges in the form of convenient pigs or ingot shapes. This practice was maintained, and the electric furnace is charged with two kinds of ingots in the same proportion. Metal is poured at a temperature 100 degrees lower than

Fig. 5—Melting department, showing aluminum induction furnace, ladle preheating kiln and round gas-fired furnaces for melting backstock

Fig. 6 — Two views of pump body casting as removed from sand, showing gating and size of main riser. Pouring position of the casting is depicted below. The part as cast weighs about 11 pounds, finished approximately 3 pounds

Fig. 7—Pouring a mold from a No. 70 ladle. Only seven molds are filled from one ladle, and pouring requires 2 minutes. Temperature drop is held below 10 degrees

in the gas-fired furnaces. This metal is checked by recording thermocouples and poured into preheated ladles, which are brought to pouring temperature in a brick wall, gas-fired kiln seen to the left of the induction furnace in Fig. 5. The temperature of 100 degrees below previous practice was decided upon by practical experiment as the optimum for this alloy when using the induction furnace.

It had been expected, from the secondary function of an induction furnace as a purifier (that is, the electrical fields tend to remove oxides whenever they are already present), that it would be necessary to clean the induction channels at frequent intervals, and that there might be down-time, either for cleaning or replacement of refractory lining material. Design of the furnace provides for this.[1] However, at this writing the furnace has run continually with no interruption whatever, for slightly over 6 months, averaging a 16-hour day, 6-day week, with an output of 150 pounds of metal per hour, for a total of more than 2000 hours running time. During this period some 200 tons of metal have been melted, poured, and cast from this furnace with no clean-out other than surface skimming, which is done once or twice during each 8-hour shift.

While use of chloride fluxes in powder form was found necessary with the previous gas-fired crucible practice, no fluxes are needed with induction melting.

It has been found most practicable to use a relatively small ladle (a No. 70), filling only seven molds at a time, as in Fig. 7, rather than risk sluggishness on the last flask with a fast-cooling heel. It takes 2 minutes to complete the pour and, since the ladles have been preheated, the actual temperature drop on the last mold has been checked at less than 10 degrees. About 80 pounds of metal are handled by the caster. Castings in the sand weigh around 11 pounds. A finished pump body weighs approximately 3 pounds. The bulk of the scrap is removed in the foundry proper, where the main riser and sprues are sawed off. Machine shop turnings and borings are not recovered here.

The induction melting furnace is a 60-kilowatt twin-coil Ajax-Tama-Wyatt center spout, tilting type, made by Ajax Engineering Corp., Trenton, N. J. In Fig. 5 this furnace is shown in the tilted position. Operators use a small electric trolley hoist which is not coupled permanently. A hook is attached to a coupling in the furnace base whenever it is necessary to pour. Furnace controls are housed in a steel cubicle, not shown. These controls include a temperature recorder, thermocouple relays, contactors, capacitors, and transformer switch control handles. Power at the plant is 220-volt, 60-cycles, stepped down to about 6 volts for operating the furnace. The unit occupies such small space that the very length of the casting floor dwarfs it altogether, as seen in Fig. 1.

The operating principle of the furnace is the same as in a short-circuited transformer. A heavy current is induced in the molten metal contained in the secondary loop, and the heat thus generated is transmitted to the hearth which is kept under continuous movement by electromagnetic forces.

One of the byproducts, of some effect upon employe morale, has been a generally cleaner foundry, and heat insulation has proved so effective that a man may touch the furnace—even lean against it—without discomfort. Heat is generated only in the metal being melted. The fact is, men like to work with it. Ingots weigh 30 pounds.

As has been seen, the sharp drop in rejected castings was spectacular with induction furnace practice, and thereafter, with melting eliminated as a major source of trouble, the other unknowns have been progressively diminished and dealt with, step by (*Please turn to page* 238)

Fig. 8—Pressure testing pump body castings. Steel jigs with rubber plugs close openings when air at pressure up to 75 pounds is applied to the castings submerged in water

QUESTIONS and ANSWERS

Warts Spoil Pattern Casting

Q.—We have many aluminum ring patterns used to make bezel rings for airports, and recently noticed that one of the patterns, which has been in use for some time, developed warts on both sides. We never have encountered that condition before, and would like to know the cause.

A.—The only reason we can account for the formation of the warts, as you term them, is that some inclusion in the alloy at the particular location is the cause. Perhaps some fine porosity existed at the same point, and the moisture penetrated to the inclusion causing it to grow or swell; forcing the metallic shell to distort. Naturally, the only way to determine the true cause of the warts would be to section the casting carefully at the places where the warts occur, and examine those portions with a magnifying glass or perhaps the microscope. However, we doubt that you will care to do that until it is necessary to discard the pattern.

Cupola Bed Height Is Too Low

Q.—We operate a small gray iron foundry in Mexico, and are having trouble with blowholes, especially any part that has to be machined. We use a cupola lined to 20½ inches which we light up and when the coke bed is well burned through we blow the cupola for 3 minutes to heat it up well. By that procedure we get hot iron on the first tap. Then we charge using 300 pounds of iron with 30-pound coke splits. We melt about 1½ tons per hour using 25 per cent steel scrap and the remainder good gray iron scrap of about the same section as the castings to be made. We use a wedge bar to check the metal, and with light castings we usually add silicon in the ladle. We had to change our sand supply since the former source was turned into a farm, and believe possibly that the trouble may originate there. With the old sand we often had to cool the iron before pouring to prevent surface blows, but now it seems as the holes are under the surface, being revealed on machining. We are going to try a new sand, and see what happens.

A.—While your difficulty may be due to the molding sand you are using, we believe that your trouble from holes may originate in melting practice. You state that the holes mainly appear after a machining cut is taken which indicates that the gas is contained within the iron, rather than gas which is generated by contact of molten metal and sand. That would blow from the outside into the metal, and usually shows on the surface of the casting.

You mention that you turn on the blast for 3 minutes before you start to charge, and we would like to point out that if the 1½ tons per hour melting rate is correct, you are melting a 300-pound charge every 6 minutes. In other words in the 3 minutes blowing you are burning enough coke to melt half a charge, and it is quite possible that your bed is burned away that much before you begin charging—and stays that way through the heat. You do not mention how much coke you place on the bed; that is the distance the coke extends above the tops of the tuyeres. We suggest that you measure the bed height in your present practice by lowering a rod or stick from the charging door; first to the top of the tuyeres, then after the bed is placed in position, and later just before charging commences.

The differences between the various marks on the rod will give you the bed above the tuyeres before and after burning. The next time try increasing the bed height a couple of inches and see what results are obtained. The next time try increasing the bed height a couple of inches more, and again observe the results. By such procedure you can determine the best bed height, and then see that each time the bed is made up to the right point.

Has Trouble with Hard Edges

Q.—We are having difficulty with hard spots and sections on thin surfaces and extremities of our gray iron castings. As we use about 20 per cent steel, we attribute the trouble to differences in melting points of that and pig and scrap resulting in improper mixing. Our cupola is 28 inches inside diameter. Iron charges are 600 pounds composed of 40 per cent pig iron containing 2.24 per cent silicon; 20 per cent steel scrap; 20 per cent medium section cast scrap, and 20 per cent returns. To that we add 6 pounds of 50 per cent ferrosilicon. Casting analysis shows 2.3 per cent silicon and 0.7 per cent manganese. Coke bed is 225 pounds with 60-pound coke splits. Limestone is used on the bed as well as soda ash, and those amounts are 23 pounds and 2 pounds respectively. To each charge 12 pounds limestone and ¾-pound soda ash are added. Heats run about 4000 pounds.

A.—Study of the figures you give indicate several possibilities which might cause the hard spots and edges in your castings. One is the coke bed in the cupola. Assuming that your coke weighs 25 pounds per cubic foot, the 225-pound bed will occupy 9 cubic feet. A cupola 28 inches in diameter has an area of 4.28 square feet. Consequently, the coke will extend about 25 inches from the bottom. You do not mention the height of the tuyeres from the bottom, but if we assume 10 inches, then the bed only is 12 inches or so above the tops of the tuyeres. Actually the bed should extend 30 to 36 inches above the tops of the tuyeres after it is burned through.

Calculation of the final silicon content from the information you give shows that the iron will contain about 2.10 per cent over the spout which does not agree with the figure you give of 2.3 per cent. Hence, we wonder if the latter is from some previous calculation, or an actual analysis from metal in the castings. If it is from analysis, presumably it is the silicon content suitable for your castings, but it might be advisable to check the analytical procedure on its accuracy. However, if the 2.3 per cent value is based on calculation, it is advisable to check those to see that they are based on the compositions of raw materials being used at present.

If after you have made the suggested changes, and still

have trouble from hard spots and edges, the condition may be remedied by addition of small amounts of graphitizing agents either to the charge or in the spout or ladle. Since you are adding ferrosilicon as a regular procedure, you could try changing the addition from the charge to the spout or ladle. Other graphitizing agents include nickel, copper, graphite, and numerous proprietary materials which are described in the advertising pages of THE FOUNDRY.

Proper Feeding Prevents Leaks

Q.—We are about to build a group of rotary pump bodies weighing from 600 to 2000 pounds. Materials used have been the 85-5-5-5, Navy 46B23 or Navy 46B8g. Castings are subjected to a maximum working pressure of 150 pounds per square inch. Hydrostatic pressure probably would run 50 per cent greater. Pump bodies must be absolutely water tight at working pressures when pumping gasoline, fresh and sea waters, and light and heavy oils. Difficulty has been in obtaining leak free castings as many have been of the "weeping" variety. To correct the latter conditions it has been suggested that castings be impregnated with sodium silicate, but understand that the Navy will not permit that.

A.—Navy 46B23 is the same as the 85-5-5-5 alloy, but Navy 46B8g differs somewhat in that it calls for an average composition of 88.75 per cent copper, 6 per cent tin, 1.5 per cent lead and 3.25 per cent zinc. It has a much higher tensile strength than the 85-5-5-5 alloy, possesses good resistance to sea water, can be used at temperatures up to 550 degrees Fahr., and is used as a steam or valve bronze.

It should not be difficult to secure sound castings to withstand the pressures you mention of 150 to 225 pounds per square inch if a little attention is given to gating and risering. Risers must be of such size to insure feeding. They must be located in such a way as to not only feed the heavy sections, but to contain hot metal. Possibly some of the trouble encountered may be due to gassing during melting, and it is suggested that melting practice be checked to see that slightly oxidizing conditions are maintained.

While a sodium silicate solution was recommended at one time for sealing certain types of aluminum alloy castings, we do not know whether that practice is used to any degree now. Synthetic resins and plastics are being used. They are injected under pressure to insure penetration, washed to remove excess on the surface, and then baked into place.

Such material may be obtained from firms whose names can be found in the advertising section.

Bushings in Permanent Molds

Q.—We have been making phosphor-bronze castings by the chill-cast method for many years such as gear blanks and short lengths, but cannot produce 12-inch lengths solid throughout. The 12-inch bushings poured in an iron mold have an unsatisfactory center which appears to be shrinkage. The alloy used is approximately 89 per cent copper and 11 per cent tin, and we would like to know how to make the 12-inch and longer bars solid and fine grained in metal molds.

A.—If the central section of the permanent mold bushings contains shrinkage voids as you seem to think, you should change the design of the mold so that adequate feeding is provided. Since metal molds are used widely in brass rolling mills for making slabs and billets several feet in length which are solid except for several inches of shrinkage pipe at the top end, there seems to be no reason why shorter lengths cannot be made just as successfully.

It might be well to point out that those molds are top poured so that the hottest metal is at the last portion to freeze. Possibly you are gating your molds at the bottom which results in the coldest metal being at the top, and the hottest at the bottom. As a consequence, the bushing freezes from the top down in addition to freezing from the outside to the interior without any feed to speak of since the gate being small freezes off first. Hence, the shrinkage appears principally in the center of the bushing.

We suggest pouring the bushing from the top, using a ring of small pop gates located about halfway between the outer periphery and the center to prevent the molten metal from impinging on the mold walls. Mold should be several inches longer than the actual length. That several inches acts as the feeding head; being cut off later just below the farthest point of the shrink pipe. The pop gates are located at the bottom of a pouring cup which can be set over the mold cavity. It may be made of core sand or of iron. In the latter case, the pouring cup with its pop gates is elevated a few inches above the mold so that the metal pourer can see the mold fill. When the metal nearly reaches the top, he cuts off pouring at a point where all the molten metal in the cup runs out and just fills the mold. In that way the cup can be used over and over again.

GANGWAY!

By J. A. Patterson

"Ya know Gus, I can't figure out if she's stuck on me or if she only comes up here every day to get her lunch warmed up!"

Mold Coating May Not Cause Wall Defect

Q.—We have been trying to cast bronze bushings 13 inches long by the centrifugal process in iron molds. Outside surface or that next to the mold wall is honeycombed and about $\frac{1}{16}$-inch deep. Interior of the casting is good. We have tried several coatings without success.

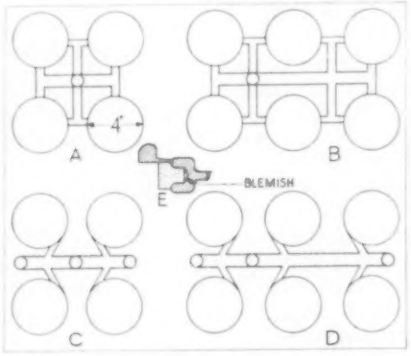
A.—You did not mention whether you are operating your centrifugal machine on a production cycle or just experimentally from time to time. It is possible that the defective surface might be caused by either a mold that is too cold or too hot. Best operating temperature seems to be from 350 to 400 degrees Fahr. With some copper-base alloys no mold coating is used, and good castings are produced. It appears that phosphor bronze and leaded bronzes require coatings, and apparently a variety of compositions or mixtures are used. Some find that a thin wash of silica flour with bentonite as the binder works satisfactorily, others use graphite with clay, refractory cement, or bentonite as the bond, and still others employ a wash comprised of a red material known as insulating powder.

Change Gating for Clean Castings

Q.—We are enclosing sketch of gating arrangement, also sample small gray iron trolley wheel. The smaller size 4 inches diameter is molded six in a flask. The larger size has four to a gate. The castings are gated in the cope over the dry sand ring cores. Periodically a considerable number of castings show a defective area on the face of the tread and always under the gate. Opinions differ on whether the shallow cavity in the face is caused by the core, by slag or by slow pouring.

A.—Close examination of the casting before it was cleaned would indicate what kind of material was lying in the cavity, but the cleaned casting under a strong glass shows traces of slag. From the appearance of the groove in the casting it is apparent that the core is perfect and is not a contributory factor to the defect. The slag either flowed in with the metal from the ladle, or was formed by the wash of the metal through the sprue, runners and gates. Extra care will prevent slag coming from the ladle. Skilfull molding practice will insure a clean passage for the metal from the pouring head to the point where it enters the mold cavity.

However, the hazard always is present and it becomes advisable to provide a gating system that will prevent this foreign material from entering the mold. The present gating system as shown at *A* and *B* is not satisfactory. In the first place it is not necessary to have two gates to each of these small castings. The second and more serious fault is that the metal falling from a straight short gate forms a pool in which any foreign material remains for at least some time. In some instances this foreign material floats to the top or lodges in some part of the mold where it is not visible. In other instances, as shown by the sample submitted, it clings to the face of the core and forms a visible cavity. The gating arrangement shown at *C* and *D* is suggested as a remedy. Metal is poured into the central sprue and flows to the ends of the runner where a relief sprue allows any foreign material to collect and float to the top. The clean metal



Suggested gating system at C and D is preferable to present system A and B to prevent small portions of foreign material from adhering to core face as at E

enters each mold cavity through a tangential gate which keeps the metal in motion and prevents any slag or dirt that escapes the gates from clinging to the face of the core.

Suggests Changes To Speed Melting

Q.—We operate a 54-inch cupola which is boshed gradually from about 30 inches above the tuyeres to 44 inches. We are melting about 8 tons per hour on 25-ton heats using 280 pounds coke and 1600-pound charges. Bed is 40 inches above the tuyeres, and we use about 75 pounds of limestone per ton of iron beginning on the bed. Our daily melts are increasing and we would like to know if elimination of the bosh will permit a higher melting rate. Our iron comes down hot, but after about 2 hours operation, melting slows down and the iron comes somewhat dull. Cupola has 6 tuyeres 6 x 15 inches, and the blast pressure is 16 ounces. Our coke is much smaller than the 5 x 8-inch size which we used in previous years, but we have to take what we can get.

A.—We can see no reason why your melting rate cannot be increased by removing the bosh as you propose, to give an inside diameter of 54 inches. A cupola lined to that diameter will melt at least 12 tons per hour as against the 8 tons per hour which is the rated capacity of a 44-inch cupola. From the figures you give of 280 pounds of coke for 1600 pounds of iron, the ratio is about 1 to 6 which is rather low, and we believe that you are using too much limestone. Cut it to 60 pounds per ton. Excess limestone will erode the lining to a considerable degree.

According to Don Reese, determination of coke and iron charges should bear a definite relationship to cupola area at the tuyeres to obtain the best operating conditions. He also recommends that the coke split be determined first and the iron charge be based on that instead of the present practice of setting a definite iron charge and adjusting the coke split to that. Reese states that the coke split may range from 9½ to 7½ pounds per square foot of cupola area. Since the area of a 54-inch cupola is 15.9 square feet, the coke split will be in round numbers 150 pounds when the value of 9½ pounds is used. With reference to relationship between coke and iron charges Reese suggests a range from 12 pounds of iron to 1 pound of coke when 10 to 15 per cent steel or less is used in the charge, to 8½ pounds of iron per pound of coke when 60 per cent or more steel is in the charge.

To make calculation easier in addition to getting a charge size easy to remember we will make the ratio 8 to 1 which gives a 1200-pound iron charge with a 150-pound coke split. Another consideration is the amount of air required per minute to melt the iron. Cupolas melt from 0.75 to 1 ton per square foot of area at the tuyeres so that a 54-inch lining with 15.9 square feet area will melt from approximately 12 to 15 tons an hour. Since it requires about 13 cubic feet of air to melt a pound of iron, it will be found that 5200 to 6890 cubic feet of air will have to be supplied per minute. It is preferable to have a blower large enough to supply the maximum blast, and control the amount going into the cupola with a blast gate.

Up to this point the bed has not been mentioned, but that does not mean it is not important. One method of determining the proper height is to multiply the square root of the blast pressure by 10½ and add 6. With a blast pressure of 16 ounces you mention, the bed for the cupola should be 48 inches above the tops of the tuyeres instead of your present 40 inches. Also that height is located after the bed has burned through properly since if wood is used to ignite the coke, it burns away and lets the coke drop down. We believe that your 40-inch bed is not quite high enough, and is the reason in your present set-up that after two hours melting slows down and the iron comes down somewhat cold.

Use Metal Mold for Tractor Wheel

Q.—We are making an experimental cast iron mold in which we hope to make a tractor wheel weighing 150 pounds. Wheel is 25½ inches in diameter with a 13-inch hole in the center. Average thickness of cast section is 1½ inches. What material would you recommend for the mold, and its composition?

A.—We believe that you can make the mold for the tractor wheel of gray iron preferably with addition of alloying

(*Concluded on page* 124)

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THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

(*Concluded from page* 122)

agents which will promote its resistance to heat and growth. Presumably the mold will be rather heavy in section, and consequently the silicon content should not be too high so that the structure does not become open and coarse. One suggested composition for metal molds is composed of 2 per cent silicon, 3.30 per cent total carbon, 0.70 per cent manganese, 0.50 per cent chromium, and 0.10 per cent vanadium. Another is practically the same except that 1.50 per cent copper is substituted for the chromium.

Other compositions which might be tried include 1.60 per cent silicon, 3.60 per cent total carbon, 0.65 per cent manganese, and 0.35 to 0.80 per cent molybdenum or 1.75 per cent silicon, 3.20 per cent total carbon, 0.70 per cent manganese, 0.40 per cent nickel, 0.40 per cent chromium, and 0.10 per cent vanadium.

Riser Does Not Suck Metal from Casting

Q.—Occasionally we have an aluminum alloy casting that shows porosity near the ribs and under the risers when subjected to X-ray inspection. We have been told the riser sucks up metal from the casting and the feeding head is too large. In our experience we never have seen a riser that is too large if placed properly to promote progressive solidification and to supply liquid metal until the casting has solidified. We shall appreciate your opinion on this subject.

A.—Your own experience is a fairly safe guide in drawing conclusions and in doubting the versions of men who flippantly confuse intangible theory with actual practice. Molten metal is under the influence of two main factors in cooling. One is reduction in volume and the other is the law of gravity. A casting contracts from the outside to the center, but the entire mass settles downward. Remove the cope from any casting and in the drag you will find an open space between the sand wall and the outer wall of the casting. You also will find that the top surface of the casting lies below the original parting line. You can turn over every casting in the shop and you will not find any open space between the bottom surface of the casting and the sand bed on which it rests.

A riser on top of a casting does not suck up any metal. Some other cause is responsible for the porosity. The riser may be too small or it may not be placed in the proper position. The riser may be large enough and in the proper position to function satisfactorily if filled with hot metal. When filled with cold metal it freezes before it has fulfilled its function. Porosity may be caused by a mold or core against which the metal will not lie quietly. Resulting ebullition or *boiling* forms bubbles, small or large, that do not work their way out, but remain trapped in the casting. Oxidized or gassed metal will result in porosity.

Reduce Hardness of Cylinder Sleeves

Q.—We have a request to make some cylinder sleeves ⅜-inch thick of an iron containing 3.15 to 3.35 per cent carbon, 2.20 to 2.35 per cent silicon, 0.60 to 0.80 per cent manganese, 0.70 to 0.95 per cent chromium, 0.20 to 0.30 per cent nickel, and 0.40 to 0.55 per cent molybdenum. Before heat treatment the brinell hardness is 255 to 302, and liners are heat treated to show a brinell hardness of 450 to 550. Can you tell us how we can produce iron of that composition that will be machinable as-cast?

A.—Alloy iron containing the amount of chromium you mention in the thickness specified cannot be produced so that it will be machinable in the ordinary sense of the word, since chromium is a carbide stabilizer and results in what the foundryman usually terms "hard" iron. In order to machine the iron as easily as ordinary gray iron it would be necessary to heat it to probably 1700 or 1800 degrees Fahr., and allow it to cool slowly in the furnace. However, that probably would lead to complications in attaining the final hardness after quenching, since the castings would have to be heated to a somewhat higher temperature before quenching. The best way to obtain definite information would be to carry on a series of tests under different temperatures including quenching and drawing.

As a general rule the sleeves you mention are given a stress relief at 1025 to 1040 degrees Fahr. for 2 hours and cooled to 400 to 450 degrees in the furnace. Then they are removed and allowed to cool in the air. Machining is accomplished with stellite type tool steels or tungsten carbide tools.

Prepare Sand for Loam Type of Molding

Q.—Is there any book published on the subject of loam molding? We are particularly interested in loam sand mixtures.

A.—So far as we know there is no book devoted exclusively to the subject of loam molding. Typical examples of loam molding practice appeared in several books written many years ago, but unfortunately these books now are out of print. At various times articles on the same subject have been presented in THE FOUNDRY. Widely practiced at one time, the method has been displaced to a considerable extent in recent years. Molds at one time made in loam, now are made by assembling a collection of dry sand cores dried in the oven, or in a somewhat similar assembly of parts made from sand bonded with cement and air dried.

The following quotation from *Principles of Iron Founding*, by the late Dr. Moldenke covers your inquiry:

"The fundamental requirements of a good loam are that when dried in the oven it should bake hard and strong and not show any signs of shrinkage in the material. Hence there should be sufficient clay in a loam to give strong bonding as well as sufficient sand to overcome the natural shrinkage in the clay when the loam is baked. Much naturally will depend on the character of the clay constituent. If this is lean and enough sand is added to overcome the shrinkage, the mass may not be able to resist the cutting action of the metal as well as the ferrostatic pressure in the mold. Hence artificial bonds are added in shape of cow hair, hay and straw rope, horse dung and similar organic material which incidentally help in proper venting. Another way to correct the trouble is to add more clay, but of the fattest kind in the shape of claywash, with just enough sharp sand to care for the increase in otherwise resulting shrinkage. The foundryman has it in his power to apply the proper remedy in case his natural loam does not quite fill the bill. It is important to differentiate between the interior and the surface material. The former must be of good bonding power but well vented, hence rather richer in the clay than absolutely necessary. Passages for gas and air must be unobstructed. The mold surfaces should have a higher proportion of sand to successfully resist the intense heat while in contact with the molten metal. At least until a sufficiently strong shell of metal has formed to preclude any further damage of shrinkage in the mold surface. Loam for the interior of the mold may run 34 per cent quartz and 66 per cent clay and fluxes. The surface finish may be but little richer than a strong molding sand. Loam must be mixed with water some time before it is used so that the moisture may permeate it thoroughly. Then it should be put through the mill for thorough kneading and mixing.

Making Wax Patterns For Molding Process

Q.—Have you any information on the lost wax method of making plaster molds where a wax core is invested in plaster and then baked out leaving a perfect impression in the mold? We wish to experiment with that type of mold for making castings centrifugally. One question that arises is what method to use in molding the wax cores.

A.—Considerable information on the lost wax method, or as it more commonly is termed at present, investment casting, is contained in an article entitled, "Precision Castings", by L. L. Wyman and D. Basch which appeared in the February, 1944 issue of THE FOUNDRY. Also Robert Nieman presented an interesting paper on the subject at the 1944 meeting of the American Foundrymen's Association.

The wax patterns used in the process are produced by injecting heated wax under pressure into a suitable mold which may be made of steel, white metal, vulcanized rubber, plastics, etc.

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MEN ... of Industry

W. B. HOLTON JR., who recently was elected president of the Valve Manufacturers Association, is president of the Walworth Co., New York. Mr. Holton resigned Feb. 1 as production consultant and head of the Valve and Fittings Section, War Production Board, a position which he had held for the past year. He is also chairman of the board of trustees of the Navy Industrial Association, a group of industrial organizations whose purpose is the continuing of present and postwar co-operation between private business and the Navy.

♦ ♦ ♦

George E. Westerholm has been appointed to the executive staff of the Peninsular Grinding Wheel Co., Detroit, where his duties will be concentrated in the engineering and production divisions of the company. Mr. Westerholm's experience in the grinding wheel industry covers over 24 years of shop operation, field engineering and laboratory development.

♦ ♦ ♦

Dr. Herluf P. Nielsen, formerly chief metallurgist, Kinney Aluminum Co., Los Angeles, has been appointed to the staff of Battelle Institute, Columbus, O., assigned to the division of nonferrous metallurgy. Dr. Nielsen, a graduate of the University of Nebraska, took his master's degree at the Rensselaer Polytechnic Institute, and his Ph.D. at University of Minnesota, and later taught metallurgy and mechanical engineering at several western colleges.

♦ ♦ ♦

John C. Somers, Industrial Products Engineering Co., Long Island City, N. Y., distributors of industrial plant equipment, has been appointed representative of Claude B. Schneible Co., Detroit, in the states of Connecticut, New Jersey and New York. Mr. Somers, a graduate of Carnegie Institute of Technology, has been located in Long Island City since 1938, engaged in sales engineering and representing a number of leading lines of plant equipment.

♦ ♦ ♦

David O. Thomas, vice president of Bendix Aviation Corp., South Bend, Ind., since 1938, has been made president, Bendix-Westinghouse Automotive Air Brake Co., Elyria, O. From 1930 to 1938 Mr. Thomas was general manager, Saginaw Malleable Iron Division, General Motors Corp., Saginaw, Mich.

♦ ♦ ♦

Donald J. Reese, who has been with the Steel Division of the War Production Board at Washington since April, 1942, has resumed his duties with the Development and Research Division of the International Nickel Co. Inc., New York.

♦ ♦ ♦

William Stark Newell, for the past 17 years president of Bath Iron Works, Bath, Me., received the honorary degree of doctor of engineering from Stevens Institute of Technology at commencement exercises held Feb. 26. Mr. Newell, who delivered the commencement address, has been associated with Bath Iron Works for 45 years. He is a graduate of Massachusetts Institute of Technology.

♦ ♦ ♦

Oliver E. Mount, secretary-treasurer, American Steel Foundries, Chicago, who retired recently as president of the Steel Founders Society of America after serving three consecutive terms, was honored Feb. 16 at a testimonial dinner in Chicago tendered by executives of steel foundries located in the society's sixth district. The dinner, at the Stevens hotel, was attended by about 70. As an appreciation of his service to the association and the steel castings industry, Mr. Mount was presented with an oil painting and a sterling silver canape tray.

♦ ♦ ♦

H. S. Gulick, formerly superintendent of foundries of the New York Air Brake Co., Watertown, N. Y., has been appointed assistant to the first vice president. Other appointments include: **Howard B. Nye,** previously assistant foundry superintendent, now general superintendent of foundries; **Peter B. Hunter,** superintendent of iron foundries; **George Johnson,** pattern shop superintendent; **J. Francis Dobbs,** formerly chemist, now superintendent of the new metallurgical and physical laboratories of the company.

♦ ♦ ♦

Frederic Crosby, formerly president, American Hoist & Derrick Co., St. Paul, has been elected chairman, a newly created post. **Harold O. Washburn** advanced from vice president to president; **Rolf E. Ljungkull,** from chief engineer to vice president of engineering; **Donald B. Botkin,** from general super-

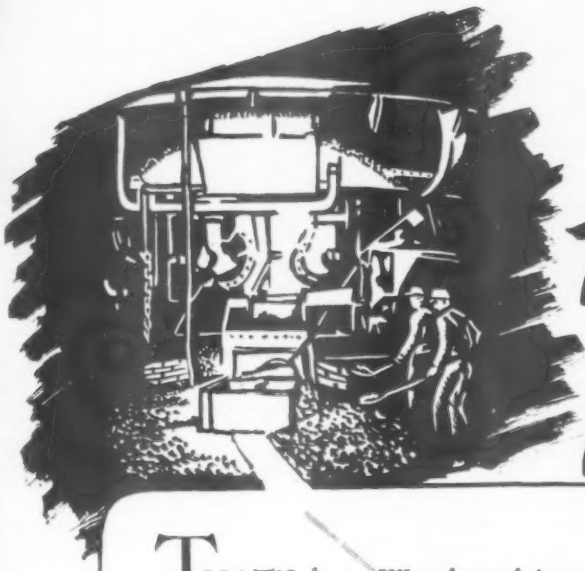
(*Continued on page* 128)

W. B. HOLTON JR.

GEORGE E. WESTERHOLM

DR. HERLUF P. NIELSEN

JOHN C. SOMERS



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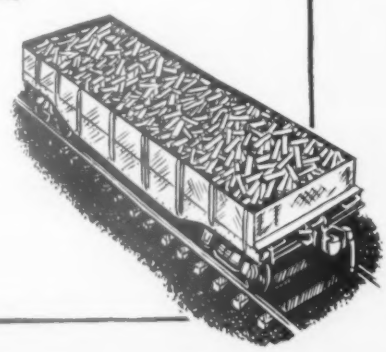

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(*Continued from page* 126)

intendent to vice president of manufacturing; and **Stanley M. Hunter,** from manager of sales to vice president of sales. **James F. Bishop** assumed the title of secretary and assistant treasurer and Robert J. Henry continues as assistant secretary.

♦ ♦ ♦

Matt J. Batka has been appointed director of plant protection at Continental Foundry & Machine Co., East Chicago, Ind., Coraopolis, Pa., and Wheeling, W. Va., succeeding **Robert B. Ritter,** who has joined the legal division of the Department of Internal Revenue, Chicago. Mr. Batka was formerly director of plant protection at the East Chicago plant.

♦ ♦ ♦

Karl B. Thews, formerly chief development engineer, chemical division, Titanium Alloy Mfg. Co., Niagara Falls, N. Y., has been appointed manager of metallurgical, chemical and ceramic sales. **Ross G. Harrison Jr.,** recently associated with Eclipse-Pioneer Division, Bendix Aviation Corp., has joined the Titanium sales department as development engineer. **Jack G. Merriam** and **Harold D. Prior** have been transferred from the Niagara plant laboratory to the Detroit area and New York sales staffs, respectively. Mr. Merriam will have headquarters in Toledo, O. **John R. Lewis,** formerly metallurgical engineer, has been appointed to the sales department, Pittsburgh territory. **Gilbert H. Jeffery** will expand the scope of field development work in the New York district.

♦ ♦ ♦

Arnold W. Brady has been appointed director of industrial relations for the Michigan and Iowa plants of Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. Mr. Brady formerly was associated with Dodge Chicago Plant, division of Chrysler Corp.

♦ ♦ ♦

Alton P. Hall has been appointed general manager of sales, American Chain & Cable Co. Inc., Bridgeport, Conn., with headquarters at 230 Park avenue, New York. Mr. Hall, a graduate of Princeton University, joined the company about a year ago as assistant general manager of sales, after having been associated with Bethlehem Steel Co. for 22 years.

♦ ♦ ♦

T. J. Gallagher has been appointed sales manager, Edw. Christiansen Co., Chicago, in charge of aluminum and magnesium ingot and product sales. Mr. Gallagher until recently was director of sales at the Detroit division of Reynolds Metals Co. and had been connected with the latter company more than 14 years.

♦ ♦ ♦

Edgar C. Hummel, Utility Electric Steel Foundry, Los Angeles, has been named representative of the industrial relations group of the National Industrial Council, an affiliate of the National Association of Manufacturers.

♦ ♦ ♦

Gilbert H. Gaus has been appointed manager of the New York branch office of Gardner-Denver Co., Quincy, Ill., suc-

(*Concluded on page* 130)

OPA AWARD TO STEEL CASTINGS INDUSTRY ADVISORY COMMITTEE

CERTIFICATES of meritorious service were presented by OPA to the Steel Castings Industry Advisory Committee when it met in conference with OPA representatives in Chicago, Feb. 12-13. Of several hundred industry advisory committees, this was the second to which an award for distinctive service was made. The citation read: "Since July 2, 1942, this committee by its sound advice and devotion to the welfare of the Nation, has helped the economy withstand the strains of global war and preserve its stability for future generations of Americans."

In the group shown here, seated from left to right, are: Miss Eva Eisenberg, economic analyst, OPA, Washington; Frank Pisula, senior accountant, Iron and Steel Branch, OPA, Washington; Rae E. Walters, regional administrator, OPA, Chicago; C. L. Harrell, vice president, Sterling Steel Casting Co., East St. Louis, Ill., chairman of the committee; A. J. McDonald, vice president, American Steel Foundries, Chicago; N. K. Anderson, president, Alloy Steel & Metals Co., Los Angeles; and T. H. Harvey, vice president, Ohio Steel Foundry Co., Lima, O.

Standing, left to right: Thomas H. Shartle, president, Texas Electric Steel Casting Co. Inc., Houston, Tex.; Lynn F. Jorgensen, chief, Iron and Steel Unit, OPA, Chicago; F. M. Robbins, president, Ross-Meehan Foundries Inc., Chattanooga, Tenn.; Morris Hershson, chief counsel, Iron and Steel Branch, OPA, Washington; E. L. Jones, chief, Industrial Materials and Manufacturers Division, OPA, Chicago; Warren M. Huff, price executive, Iron and Steel Branch, OPA, Washington; George Alston, secretary-treasurer, General Steel Castings Corp., Eddystone, Pa.; Herbert Farrell Jr., vice president, Farrell-Cheek Steel Co., Sandusky, O.; Weldon Welfling, chief of Castings Section, Iron and Steel Branch, OPA, Washington; M. A. Fladoes, president, Sivyer Steel Casting Co., Milwaukee; Charles Sweeney, chief, Accounting Section, Iron and Steel Branch, OPA, Washington; E. E. Burk, assistant to works manager, Commercial Steel Castings Division, Otis Elevator Co., Buffalo; Lt. M. H. Blackshear, USN, liaison officer between Navy and OPA, Washington; J. A. Sauer, president, Symington-Gould Corp., Rochester, N. Y., vice chairman of committee; C. L. Snowdon Jr., vice president and secretary, Reliance Steel Casting Co., Pittsburgh, secretary-treasurer of committee; and Clarence Tolan Jr., president, Dodge Steel Co., Philadelphia.

Completing the personnel of the committee, but absent, were: C. W. Howat, district sales manager, Continental Foundry & Machine Co., Pittsburgh; and L. C. Wilson, general manager, Reading Steel Casting Division, American Chain & Cable Co. Inc., Reading, Pa.

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GOOD CASTING!

Every good fisherman knows that it takes good casting to reach the big fellows . . . and every good foundry man knows that a flaw in a casting means complete waste, of time, material and money. That's why it's important to specify DAYTON OIL *. . . your assurance of unvarying, uniform quality plus complete and lasting satisfaction.*

The

DAYTON OIL COMPANY

DAYTON 1, OHIO

STEEL CORE AND MOLD WASHES - BINDER AND CORE PASTE - CORE WASHES - CHILL COATINGS

(*Concluded from page* 128)

ceeding **G. V. Leece,** vice president, who has been placed in charge of the company's export division. Mr. Gaus, a graduate of Massachusetts Institute of Technology, has been sales engineer in the New York office of Gardner-Denver for the past 7 years. Previous to that he was engaged for 18 years in engineering and sales work for industrial, power, sewage plants, and water works, in the New York area.

♦ ♦ ♦

Titanium Alloy Mfg. Co., Niagara Falls, N. Y., has expanded its research and laboratory facilities and technical staff, and the following new appointments have been made: **Ernest H. Wyche,** formerly with Rustless Iron & Steel Co., and Carnegie-Illinois Steel Corp., has been appointed metallurgical engineer; **A. R. Fowler,** previously with Eastman Kodak Co. and Lake Ontario Ordnance Co., has been appointed chemical engineer; **Robert Anibal,** formerly of Kent State Teachers College and Columbia Chemical Co., and **Sarkis Saryan** have been appointed analytical chemists. Other appointments include **J. S. Geiger** as research associate, and **Dr. Carl Curtis. Leonard G. Renouf,** a member of the laboratory staff for the past 8 years, has been appointed superintendent of refractory production.

♦ ♦ ♦

John J. Brodak, foundry technician and assistant superintendent, Swedish Crucible Steel Co., Detroit, has been appointed foundry superintendent. Prior to 1943 he was associated with the Walworth Co., Washington Park, Ill.

♦ ♦ ♦

Albert M. Hall, formerly research metallurgist, International Nickel Co. Inc., New York, has been appointed to the staff of Battelle Institute, Columbus, O., where he will be engaged in metallurgical research. Mr. Hall is a graduate of Columbia University.

♦ ♦ ♦

Thomas W. Pettus has been appointed president of National Bearings Metals Division of American Brake Shoe Co. Mr. Pettus was formerly executive vice president of National Bearing Metals Corp. until its consolidation recently with American Brake Shoe Co.

♦ ♦ ♦

C. E. Seaman, eastern representative, National Founders Association, with district offices in New York, has been made an industry panel hearing member of the Second Regional War Labor Board, with jurisdiction in New York state and parts of New Jersey.

♦ ♦ ♦

Richard K. Durkan has been elected vice president, M. W. Warren Coke Co., St. Louis. **H. Ben Wessel** has been elected secretary, and **Robert E. Woods,** treasurer.

♦ ♦ ♦

John D. Homan has been appointed regional sales representative of the Stearns Magnetic Mfg. Co., Milwaukee, with headquarters in Tampa, Fla.

♦ ♦ ♦

N. K. Anderson, formerly secretary and general manager, Alloy Steel & Metals Co., Los Angeles, has been elected president.

♦ ♦ ♦

Don N. Watkins has been elected to the board of directors, Laclede-Christy Clay Products Co., St. Louis, succeeding **A. H. Killinger.** Mr. Watkins is president of Steel Publications Inc., Pittsburgh, and early in the war served with WPB at Washington.

♦ ♦ ♦

David C. Prince, vice president, General Electric Co., Schenectady, N. Y., has been put in charge of the company's General Engineering Laboratory. Mr. Prince formerly handled application engineering for the apparatus department and has been chairman of the special planning committee for General Electric.

♦ ♦ ♦

Henry T. Chandler, formerly assistant to the president, Vanadium Corp. of America, New York, has been elected a vice president. **Benton H. Grant,** formerly assistant to the president, has been appointed an assistant vice president.

♦ ♦ ♦

John H. Collier, president of the Crane Co., Chicago, has been elected a director of the Allis-Chalmers Mfg. Co., Milwaukee, filling the post left vacant by the resignation of Capt. Lester Armour, Chicago.

♦ ♦ ♦

Lewis P. Wilson, for the past year metallurgist, Oscar W. Hedstrom Corp., Chicago, has become research metallurgist, Western Cartridge Division, Olin Industries Inc., East Alton, Ill.

Book Review

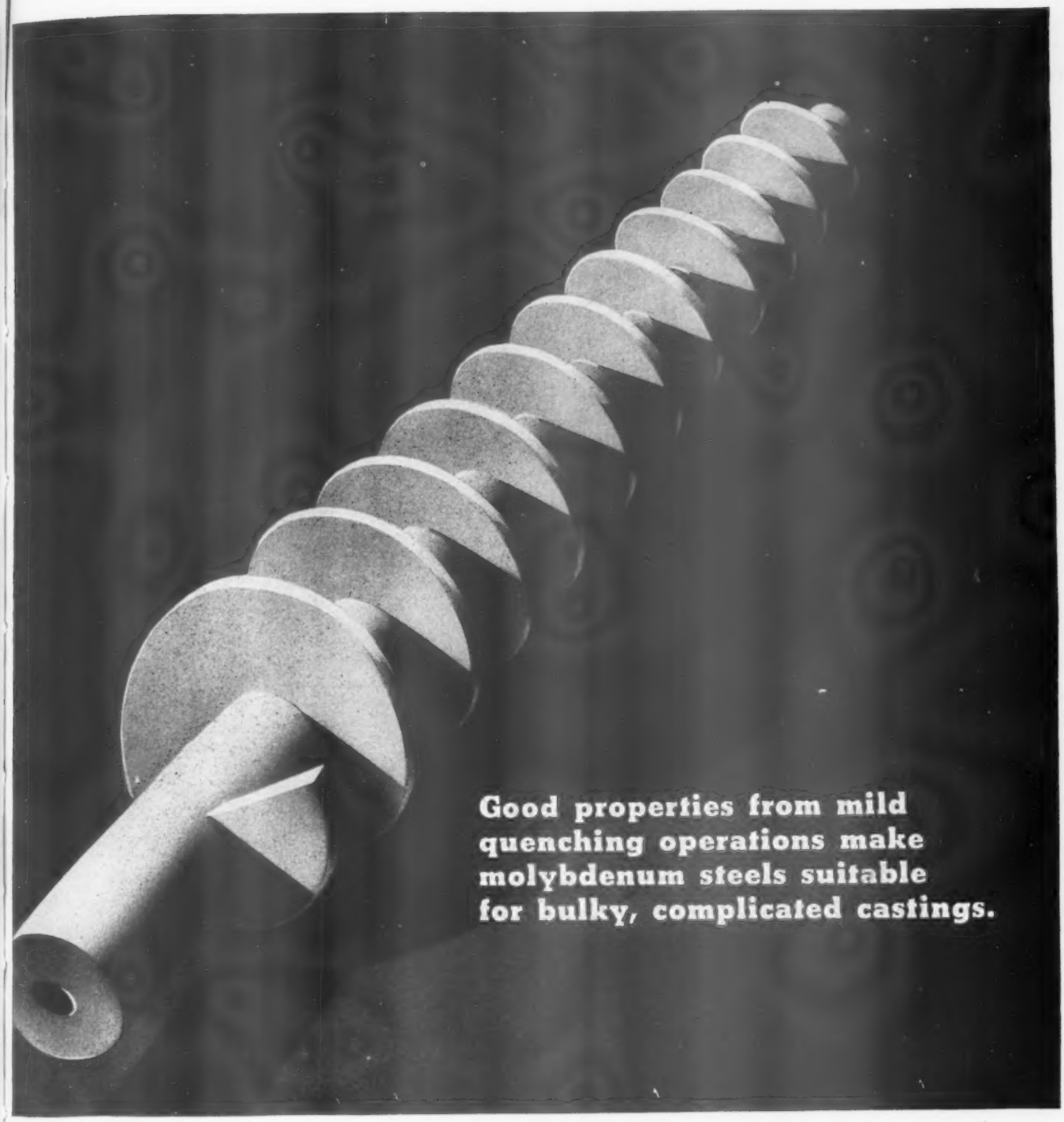
Aluminum, by N. H. Engle, H. E. Gregory and Robert Mosse, cloth, 494 pages, 6 x 9 inches, published by Richard D. Irwin Inc., Chicago. Price $6.

Bureau of Business Research of the College of Economics and Business, University of Washington, Seattle, undertook an appraisal of the postwar outlook for aluminum at the request of Gov. A. B. Langlie since the Pacific Northwest, and more particularly the state of Washington, has become one of the leading producers of that material.

The authors made an extensive survey of the aluminum industry which resulted in this book. It is divided into four main sections with an appendix and, comprises 19 chapters. First section is devoted to a discussion of the factors of aluminum production and deals with world bauxite resources, clay and other materials, electric energy, labor and capital and management. Second section relates to the aluminum industrial structure and describes economics of bauxite and alumina production, aluminum reduction industry, fabrication and finished products, cost of production, and regional costs of production.

Third section deals with aluminum markets and pertains to such phases as markets past and present, transportation market, industrial market, delivered costs to market centers, and magnesium competition. Fourth and final section is titled "Recommendations for Public Policy," and discusses a program for allocation of world bauxite reserves and proposed disposition of government-owned aluminum plants.

BRAZILIAN MISSION: *Members of the Brazilian technical mission to the United States recently toured technical and scientific laboratories throughout the country. The group is shown with Clyde Williams (second from right), director, Battelle Institute, Columbus, O., while inspecting Battelle's engineering laboratories*



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ARMY E NAVY

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Climax Molybdenum Company

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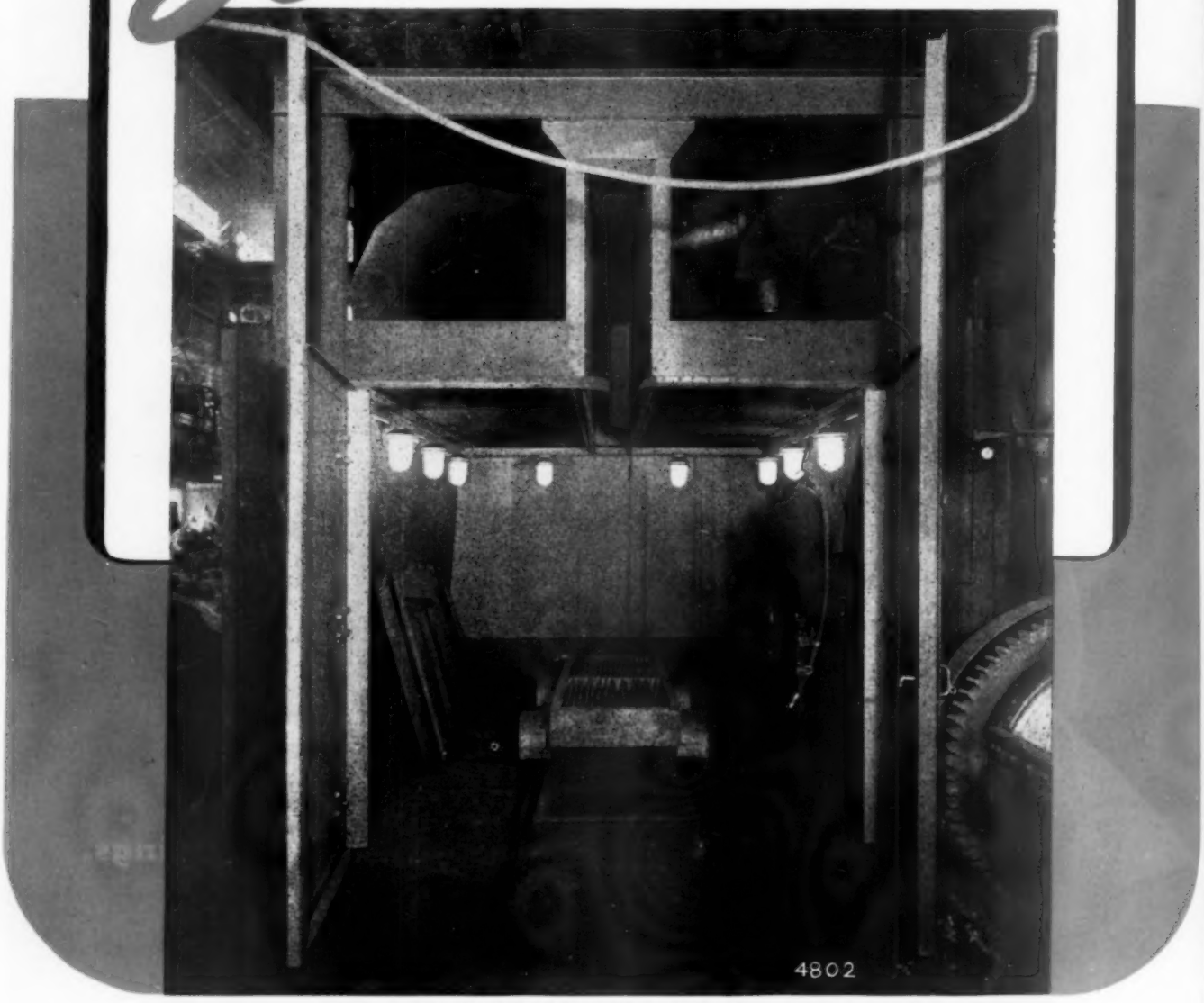
SLY BLAST ROOMS *Better-Built* OFFER EXCLUSIVE ADVANTAGES



A typical Sly Blast Room for a jobbing foundry

Castings of moderate weight are placed against the sidewall for cleaning as shown; heavier castings are handled on the car. Provision has also been made for future installation of a monorail.

Excellent illumination—from an ample number of dust-tight lighting fixtures.

Construction is exceptionally rigid—walls and doors have an extra layer of steel (3/16" wear plates).

The ceiling is of *triple* construction and provides over-all down-draft ventilation.

The floor is made of grating and perforated plates. It is unmatched for strength and safety.

Before you buy, it will pay you to look into these exceptional features of Sly Blast Rooms. We shall be glad to send you full information or arrange for representative to call.

THE W. W. SLY MANUFACTURING CO. • 4753 Train Avenue Cleveland 2, Ohio

SLY INDUSTRIAL DUST CONTROL

TUMBLING MILLS • BLAST CLEANING EQUIPMENT

Foundry Statistics

Malleable Iron Castings

	Production (Tons)			New Net Orders (Tons)		
	1945	1944	1943	1945	1944	1943
Jan.	83,742	75,594	63,572	97,153	93,855	73,524
Feb.	.....	74,812	66,401	.....	79,352	87,728
Mar.	.....	81,480	78,143	.....	90,038	85,744
Apr.	.....	69,820	72,559	.....	88,169	74,241
May	.....	70,555	69,959	.....	92,285	77,768
June	.....	70,993	69,111	.....	103,692	78,289
July	.....	61,320	66,011	.....	106,626	91,653
Aug.	.....	74,297	67,615	.....	71,307	108,505
Sept.	.....	74,628	74,874	.....	49,502	99,911
Oct.	.....	80,505	74,254	.....	76,536	101,510
Nov.	.....	79,629	72,077	.....	48,149	93,370
Dec.	.....	76,187	75,188	.....	69,972	81,978
Total	.....	889,820	849,764	.....	969,483	1,064,224

Steel Castings

	Shipments (Tons)		Production (Tons)		New Net Orders (Tons)	
	1944	1943	1944	1943	1944	1943
Jan.	237,570	.....	159,795	154,736	167,739	213,130
Feb.	211,958	.....	161,359	151,530	173,592	191,217
Mar.	224,913	.....	174,626	176,470	162,575	202,731
Apr.	204,279	.....	155,778	161,403	175,053	165,792
May	210,360	.....	161,783	163,812	176,993	192,531
June	200,237	.....	157,444	163,934	181,816	171,774
July	176,735	197,592	131,940	158,783	169,921	187,281
Aug.	204,833	183,842	154,911	158,832	171,309	200,634
Sept.	189,443	202,049	144,458	157,818	129,847	214,086
Oct.	197,772	198,753	150,719	163,888	146,116	211,341
Nov.	196,475	202,490	146,411	158,813	120,667	209,276
Dec.	.....	213,602	.....	158,626	.....	173,627
Total	.....	.....	.....	1,928,645	.....	2,333,420

Note: Shipments for sale and own use; production and orders for sale only.

Aluminum Casting Shipments

(In millions of pounds)

	Total	Sand	Perm. Mold	Die
1943	459.5	304.2	89.6	65.7
Jan.	33.1	21.9	6.4	4.8
Feb.	33.3	22.0	6.5	4.8
Mar.	38.7	25.3	7.9	5.5
Apr.	37.1	24.3	7.6	5.2
May	37.7	25.0	7.7	5.0
June	36.3	24.1	6.9	5.3
July	37.2	24.7	7.1	5.4
Aug.	38.2	25.4	7.2	5.6
Sept.	40.8	27.2	7.9	5.7
Oct.	42.7	28.5	8.0	6.2
Nov.	43.0	28.5	8.3	6.2
Dec.	41.4	27.3	8.1	6.0
1944	514.5	321.1	106.3	84.2
Jan.	44.1	29.4	8.3	6.4
Feb.	45.9	30.2	8.0	7.5
Mar.	49.5	31.4	9.6	8.1
Apr.	42.9	27.0	8.3	7.3
May	44.7	27.9	8.9	7.5
June	42.4	25.9	8.8	7.4
July	38.7	24.5	7.7	6.2
Aug.	43.2	26.9	9.2	6.9
Sept.	41.5	25.5	8.9	6.9
Oct.	42.1	25.1	9.8	7.0
Nov.	40.5	24.3	9.6	6.4
Dec.	39.0	23.0	9.2	6.6

Foundry Equipment, Supplies

(In thousands of dollars)

	Shipments	Orders	Back-logs
1943	53,806	32,094	.....
Jan.	4,949	2,788	18,759
Feb.	4,953	2,551	16,585
Mar.	5,863	2,913	14,899
Apr.	5,365	2,676	12,904
May	4,718	1,774	10,513
June	4,825	2,319	9,017
July	4,017	2,405	8,345
Aug.	3,513	1,989	7,429
Sept.	3,881	2,070	6,930
Oct.	3,792	3,401	7,092
Nov.	3,563	3,422	7,076
Dec.	3,217	3,786	7,731
1944	41,914	44,903	.....
Jan.	3,336	3,515	7,910
Feb.	3,426	4,338	8,822
Mar.	3,679	4,370	9,513
Apr.	3,496	2,424	8,441
May	3,547	4,089	8,983
June	3,554	3,906	9,335
July	3,027	3,086	9,394
Aug.	3,818	4,115	9,691
Sept.	3,445	3,465	9,711
Oct.	3,758	4,293	10,246
Nov.	3,451	3,401	10,196
Dec.	3,377	3,901	10,720

Magnesium Casting Shipments

(In thousands of pounds)

	Total	Sand	Perm. Mold	Die
1943	65,967	59,123	3,978	2,866
Jan.	4,376	3,934	253	189
Feb.	4,445	3,931	299	215
Mar.	5,364	4,802	300	262
Apr.	5,237	4,694	284	259
May	5,263	4,652	343	268
June	4,690	4,159	296	235
July	4,940	4,406	290	244
Aug.	5,238	4,770	257	211
Sept.	6,008	5,391	390	227
Oct.	6,774	6,096	431	247
Nov.	6,792	6,068	452	272
Dec.	6,840	6,220	382	238
1944	83,979	75,221	6,396	2,362
Jan.	6,984	6,210	536	238
Feb.	7,293	6,603	469	221
Mar.	8,242	7,574	496	172
Apr.	7,520	6,922	413	185
May	7,357	6,664	514	179
June	6,535	5,729	598	208
July	6,481	5,653	656	172
Aug.	6,934	6,143	563	228
Sept.	6,945	6,147	606	192
Oct.	6,738	6,062	515	161
Nov.	6,639	5,919	521	199
Dec.	6,315	5,595	509	207

GRAY IRON CASTINGS—Production, Shipments, New Orders, Unfilled Orders

MONTHLY TOTALS (tons)—1944

	Production	Shipments	Orders	Backlogs
Jan.	793,884	765,423	517,466	2,259,158
Feb.	772,764	764,369	650,238	2,115,027
March	840,890	828,648	867,889	2,184,268
April	765,784	757,880	732,892	2,159,280
May	789,007	790,674	835,966	2,204,572
June	765,581	763,459	772,070	2,213,183
July	698,418	689,744	790,206	2,313,645
Aug.	778,388	778,205	799,754	2,335,194
Sept.	768,661	744,954	714,083	2,304,323
Oct.	788,196	780,453	739,234	2,296,690
Nov.	769,734	760,383	790,706	2,300,350
Dec.	743,710	741,534	885,748	2,474,548

CAST IRON PRESSURE PIPE—1944

	Production	Shipments	Orders	Backlogs
Jan.	36,146	32,080	32,010	73,824
Feb.	32,004	31,303	32,155	74,676
March	34,570	36,022	47,964	86,618
April	32,807	32,808	34,650	88,460
May	38,247	41,085	43,793	91,168
June	36,167	40,400	39,737	90,505
July	39,314	40,821	64,901	114,585
Aug.	44,009	46,031	45,523	114,077
Sept.	45,645	44,761	61,797	131,113
Oct.	46,123	51,603	45,659	125,169
Nov.	47,868	45,653	53,207	132,723
Dec.	43,527	43,305	49,638	139,056

BY TYPE—LATEST MONTH REPORTED

Type of Casting	Production	Shipments	New Orders	Unfilled Orders
Cast iron pressure pipe	43,527	43,305	49,638	139,056
Cast iron soil pipe	13,880	13,218	23,478	95,308
Chilled car wheels	72,620	73,428	55,789	215,638
Ingot molds	166,511	169,018	236,511	355,017
All other gray iron	447,172	442,565	520,332	1,669,529
Total Dec. 1944	743,710	741,534	885,748	2,474,548

CAST IRON SOIL PIPE—1944

	Production	Shipments	Orders	Backlogs
Jan.	11,322	11,369	10,235	12,344
Feb.	12,801	13,329	19,031	18,046
March	14,585	14,224	19,349	23,171
April	13,351	13,923	20,676	29,924
May	13,653	16,519	21,832	35,237
June	13,969	16,204	29,369	48,402
July	12,523	14,885	23,480	56,997
Aug.	15,103	15,945	19,355	60,407
Sept.	13,730	15,200	21,796	67,003
Oct.	14,558	15,417	23,733	75,319
Nov.	15,708	15,520	25,418	85,217
Dec.	13,880	13,218	23,478	95,308

WPB figures reported by Bureau of the Census

At Left: A typical load of castings being cleaned in one of the two 48" x 72" Wheelabrator Tumblasts used by Crucible Steel Castings Co. One Tumblast is used for green castings, the other for annealed work.

Large, heavy steel castings are cleaned in two Special Wheelabrator Cabinets, one of which is shown above. Green castings with gates, risers and cores are cleaned in a 3-pass Cabinet—annealed castings being handled in a 2-pass Cabinet. Each machine will clean up to 80 tons in 8 hours.

BRIEF FACTS ABOUT WHEELABRATING

Airless Wheelabrating is synonymous with high-speed, low-cost cleaning performance. Abrasive is thrown in a continuous, controlled stream from a centrifugal wheel, as illustrated. Compressed air, with its costly power and equipment requirements, is entirely eliminated. The standard 19½" dia. wheel, using only 15 H.P., hurls up to 300 pounds of abrasive per minute. This tremendous flood of cleaning power scours heavy loads of castings brilliantly clean in only a few minutes.

Get This Free Booklet On Foundry Equipment

Plans for mechanizing your foundry should begin with a consideration of modern equipment such as you will find in the American Line Catalog: Airless Wheelabrator and Airblast equipment, Dust Collectors, Sandcutters, Core Rod Straighteners and Metal Washing Equipment. Get your copy today.

THE AMERICAN WOLDER

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

220 tons of STEEL CASTINGS WHEELABRATED IN 8 HOURS

at CRUCIBLE STEEL CASTINGS CO.
MILWAUKEE, WIS.

When Crucible Steel Castings Co. of Milwaukee was getting into heavy production of electric steel castings for war equipment, it was found that the majority of the work was too large and bulky for standard blast cleaning machines, and individual handling in blast rooms would be both slow and uneconomical with the available labor supply.

The answer to this problem was found by installing two Wheelabrator Special Cabinets for cleaning the heavy castings and two 48" x 72" Wheelabrator Tumblasts for the smaller work.

The heavy green castings, with gates and risers attached and many containing cores, are brought by monorail conveyor from the shakeout to a special 3-pass Wheelabrator Monorail Cabinet where they are carried on hooks in an S-shaped path before three Wheelabrator blast units.

These units are staggered to provide blast coverage of all sizes of work. Each casting-laden hook is stopped in front of each Wheelabrator and rotated in the blast stream for a predetermined length of time. Since the abrasive field of each wheel strikes the rotating castings at a different angle, all crevices and pockets are thoroughly cleaned.

A second two-pass Wheelabrator Monorail Cabinet is utilized for finish blasting after annealing. In this machine the work makes two passes before three Wheelabrators. Operation is essentially the same as for the other machine, with equally high production.

The smaller steel castings which can be tumbled are cleaned in two 48" x 72" Wheelabrator Tumblasts. One of the machines is kept busy with the green castings and the other is devoted exclusively to annealed work.

American's solution of this problem has provided efficient cleaning on a mass production basis . . . 220 Tons in 8 hours.

The Answer To Your Problem

The most efficient and economical way to handle your cleaning problem can be determined by sending products to our laboratory, where equipment of all kinds is available for testing purposes. Avail yourself of this service today—doing so involves no obligation whatever.

American

FOUNDRY EQUIPMENT CO., 505 S. BYRKIT ST., MISHAWAKA, IND.

THE FOUNDRY IS A GOOD PLACE TO WORK

around DETROIT

BY A. H. ALLEN
Detroit Editor,
The Foundry

Three-year drop of 25 to 50 per cent in worker productivity is crux of manpower problem in automotive industry . . . . Precision castings seen influencing ferrous sand foundry practice

FOUNDRIES continue to "get it in the neck" as far as the public is concerned. Latest instance was the hearing of the Mead war investigating committee of the Senate which finally got around to making its long-promised investigation of manpower utilization in the Detroit area a couple of weeks ago. In the long hours of haranguing by union leaders before the three senators of the committee, one of the principal points emphasized was idle foundry capacity, specifically, in the words of one unionist, "at the Ford Motor Co. foundry at the Rouge plant where foundry personnel declined from 14,464 to 10,220 between January and September, 1944."

Union leaders even had ready explanations for the situation—difference in wage scales between foundry work and other work, as well as between independent foundries and the so-called captive foundries; and the fear of workmen that they will be "back in breadlines" in peacetime because of the lack of security in foundry jobs. Then they went on to say that Ford paid higher wages for foundry operators than did other plants, that the company deliberately bid high on castings contracts to avoid having to take them.

Senators Are Impressed

The unfortunate part of these half-truths is that they tend to impress investigating senators who do not know a molding machine from a cupola. Actually, there are several different foundries at the Ford Rouge plant where a variety of metals are cast, including aluminum, magnesium, brass, iron, steel, malleable iron, etc. Most of them are operating at a fairly high rate, with the exception of what is called the new steel foundry, a large electric furnace plant which was installed over a year ago at the request of the government to supply tank and other armor castings. Because of cancellation of the Ford tank contract, it never operated anywhere near its peak, and probably never will during this war. Some malleable iron castings are being produced there now. This unit, and the large gray iron foundry, which is operating at around 75 per cent or better, are the two production foundries at the Rouge plant.

However, it is ridiculous oversimplification to infer that just because this excess capacity exists at the steel foundry it would provide the immediate answer to critical castings requirements (cylinder blocks, heads, etc.) in the war program. The impossibility of adapting small job shop runs to a large production foundry is well known, and there is nothing any senator can do about it. As a matter of fact, the Ford gray iron foundry could take on 25 per cent more tonnage without hiring a single additional man if there were some way to persuade workers to raise their productivity to a normal level.

Productivity Fallen Off

Here is the crux of the whole manpower problem as it exists today—productivity. In three years it has fallen off anywhere from 25 to 50 per cent throughout the automotive industry, and there are indications the slump is nothing more than a deliberate slowdown and job stretch-out, engineered by perhaps 5 per cent of the total working force who comprise the militant or hot-head element in union labor which is running the show. The percentage may be somewhat larger in the smaller foundries, but most managements will tell you that an overwhelmingly large proportion of their men are of the calm and collected type who are perfectly willing to do an honest day's work. However, a militant minority, realizing that they enjoy the full protection of the union, decides otherwise and enforces, with physical violence if necessary, a slow rate of output and encourages such infractions of plant rules as loafing, sleeping on the job, molesting other workers, smoking in restricted areas, etc.

When management attempts to enforce discipline against such recalcitrants by suspending them or discharging them, other hotheads immediately seize on the action as cause for work stoppage. A "grievance" then has been manufactured and it must be processed through all the red tape of the War Labor Board while production meanwhile is curtailed or stopped. With most plants having established grievance procedures to follow in such cases, there is not the remotest excuse for these deliberate interruptions.

A showdown is at hand right now in Detroit plants over whether management is going to have the right to enforce plant discipline, and if it were not for the pressure of war production, there would be scores of plants closed tight until the issue was decided.

• • •

WHAT is to be the likely effect of the rapid development of precision casting techniques on the production foundry? This is a favorite topic for current debate, and has many ramifications. It must be remembered that as yet precision casting has not advanced very far in a competitive way with ferrous sand castings, but at least the process has demonstrated the possibility of producing castings to precision dimensions, with superior finish, and in the harder and higher melting point materials (in contrast to zinc and aluminum die castings). The general run of precision castings produced in quantity thus far has been in the weight range of a few ounces to something over one pound per piece, although an exception is noted in the case of one supplier here which has been experimenting with investment castings in steel weighing around 70 pounds each.

Present Cost Is High

In any event, the cost of investment casting is considerably beyond the level of ferrous sand castings at the moment. At the same time the designer, noting the excellence of finish and the minimum amount of machining required, may tell the sand casting supplier, in effect, "Well, if they can do it, why can't you?" This could, and probably will, lead to increasing attention to improving the dimensional control and finish of conventional types of iron and steel castings made in sand. There are some who will go so far as to predict eventually the disappearance of sand altogether in the production of long-run repetitive type castings.

Whether its successor is to be metal or some new refractory, these crystal-gazers cannot yet determine, but they point out that the elimination of sand from the foundry in favor of some other mold substance might be a long step toward minimizing the dirt and dust hazards of the castings industry.

• • •

THE blastola, or hot metal cupola, installed by Rotary Electric Steel Co. here for supplying hot metal to electric furnaces has been gathering dust for many months now, and unless the government decides to dump a few more thousand dollars into experimentation, it probably will continue dormant. Foundrymen disagree on its potentialities, some maintain-

(*Concluded on page* 138)

SPRING MOUNTED

IS THE ANSWER!

For shock loading or where very heavy loads must be handled on Roller Conveyer, Mathews Spring-Mounted construction should be considered. Spring-Mounted Roller Conveyer is made in three styles, and is establishing service records in heavy industries all over the United States and Canada. Your Mathews Field Engineer can explain how it works and why the Mathews design is superior to other available types of Spring-Mounted Roller Conveyer. He can tell you how its application has minimized the costly maintenance which is usually necessary on Roller Conveyer used under very severe conditions. You will readily understand how the principle of pre-compression protects the bearings and axles of the rollers, yet, at the same time, prevents any bouncing action from taking place. Descriptive literature is available on request.

Mathews Conveyer Company

ELLWOOD CITY, PENNSYLVANIA

MANUFACTURERS ASSOCIATION, INC. FOUNDRY EQUIPMENT

(*Concluded from page* 136)

ing that if it had been operated as a straight foundry cupola it might have worked, but that as a combination cupola and blast furnace it would never prove successful. Similar equipment has been installed by Copperweld Steel Co., Warren, O., but so far as is known has not progressed much further than the Rotary project which did operate intermittently over a period of several months but never in the way its designers had hoped.

Photography of ATOMS IN METALS

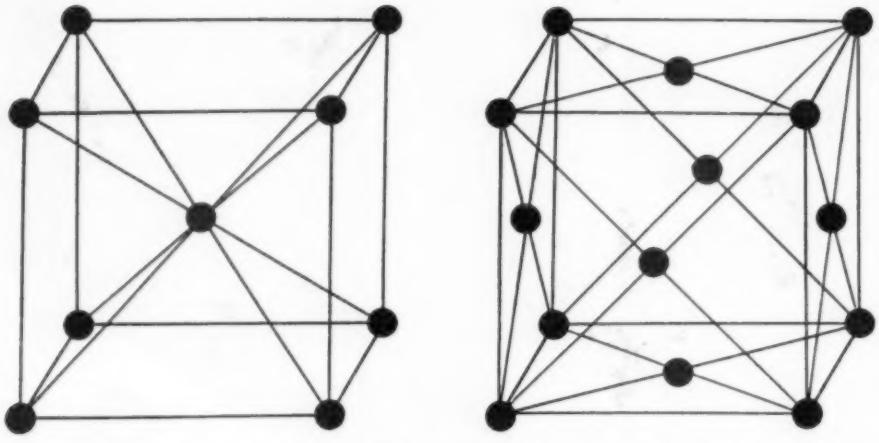


Fig. 1—Drawings showing distribution of atoms in units of structure of ordinary alpha iron (left) and aluminum (right)

METALS, like other substances, are known to be composed of atoms. The characteristics of a given metal depend both on the kind or kinds of atoms of which it is composed and on the relative arrangement of these atoms in space. Chemical analysis tells us the kinds of atoms. X-ray diffraction data yield information about their arrangement.

As an aid in the deduction of new structures and in the presentation of the results of structure determinations, the Kodak Research Laboratories have recently developed a method, originally conceived by the famous English physicist Sir Lawrence Bragg, for utilizing x-ray data to obtain pictures of the actual structures. Such a picture shows a projection of the unit of the structure pattern. In other words, it shows the arrangement of atoms in the unit as viewed from a great distance.

The results may be illustrated by two simple examples. The distributions of atoms in the units of structure of ordinary alpha iron and of aluminum, respectively, are as shown in the drawings in Fig. 1. The dots represent atomic centers; the lines are merely to help in the visualization of their relative positions. These two types of arrangement are, for obvious reasons, known as the body-centered cubic and the face-centered cubic structures.

Pictures of these two structures, made by the new method from x-ray data by Armstrong and by James, Brindley and Wood, are shown in Fig. 2. They show the arrangements of atoms, as viewed from a great distance in a direction parallel to a cube edge. The magnifications are about 150,000,000 and 100,000,000, respectively.

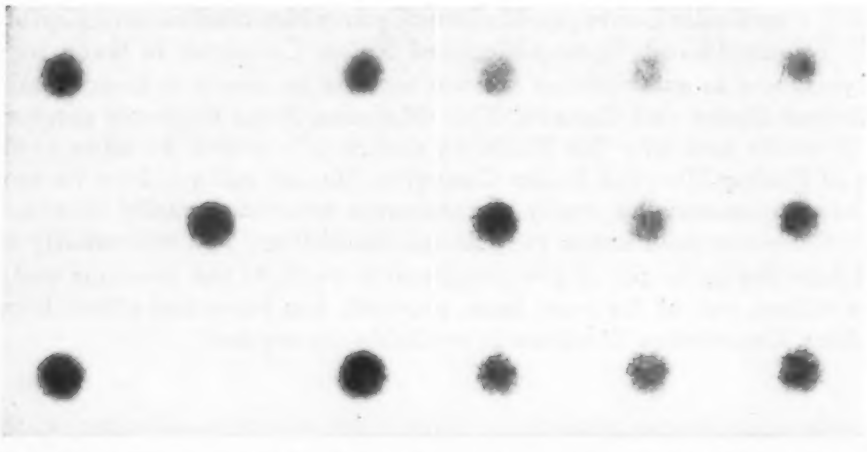


Fig. 2—Pictures of atomic distribution in structures of iron and aluminum, made by new method from x-ray data

It may be noted that a form of iron (gamma-iron) which is stable at high temperatures has the same type of arrangement (face-centered cubic) as aluminum but the kinds of atoms and the distances between them are different.

The photographs were made by superimposing exposures through 100 or 200 square patterns of light and dark bands, of different spacing and different orientation, on 35 mm. film. The choice of band patterns and the time of exposure through each are determined by the x-ray data.

This method of structure photography is expected to be of considerable use in the analysis of the atomic arrangements in complex structures, not only of metals and of alloys, but also of oxides and many other crystalline substances. As more and more structures become known, scientists become better able to correlate the characteristics of substances with their structures and so to predict the properties of hypothetical new materials and the compositions of substances which would be expected to have certain desired properties.

Study Gas Effect On Copper Alloys

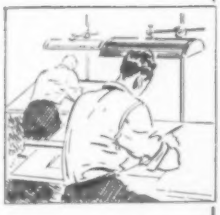
Under the sponsorship of the Nonferrous Ingot Metal Institute a study of gases and other factors affecting the soundness of castings made from copper-base alloys has been instituted in the process metallurgy laboratories of Battelle Institute, Columbus, O. Objective of the research is a study of factors in production which promote soundness and good physical and mechanical properties.

Book Review

Colorimetric Determination of Traces of Metals, by E. B. Sandell; published by Interscience Publishers Inc., 215 Fourth avenue, New York. Price $7.

Colorimetric determination of traces of elements, especially of metals, has made great advances in recent years and the author has presented a number of modern methods in this field of analysis. His aim has been to present a limited number of methods which currently appear best suited for dealing with metal traces.

The work is highly technical and covers a broad field, divided into two parts, general and special. The first deals with the subject in general and the second with some 49 metals, with methods applicable.



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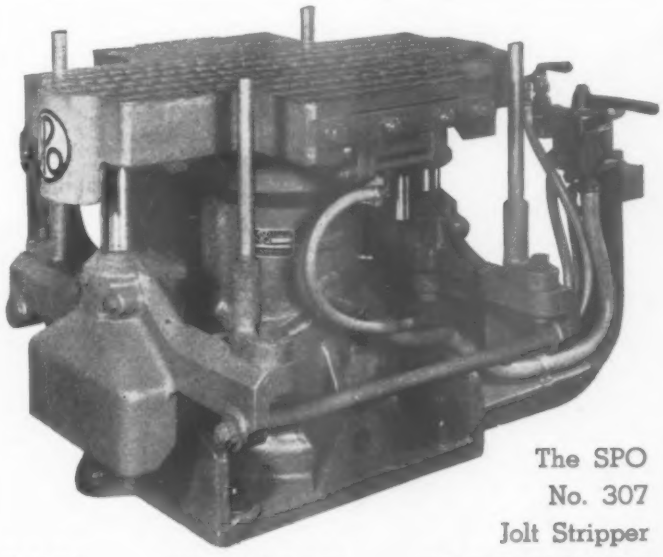

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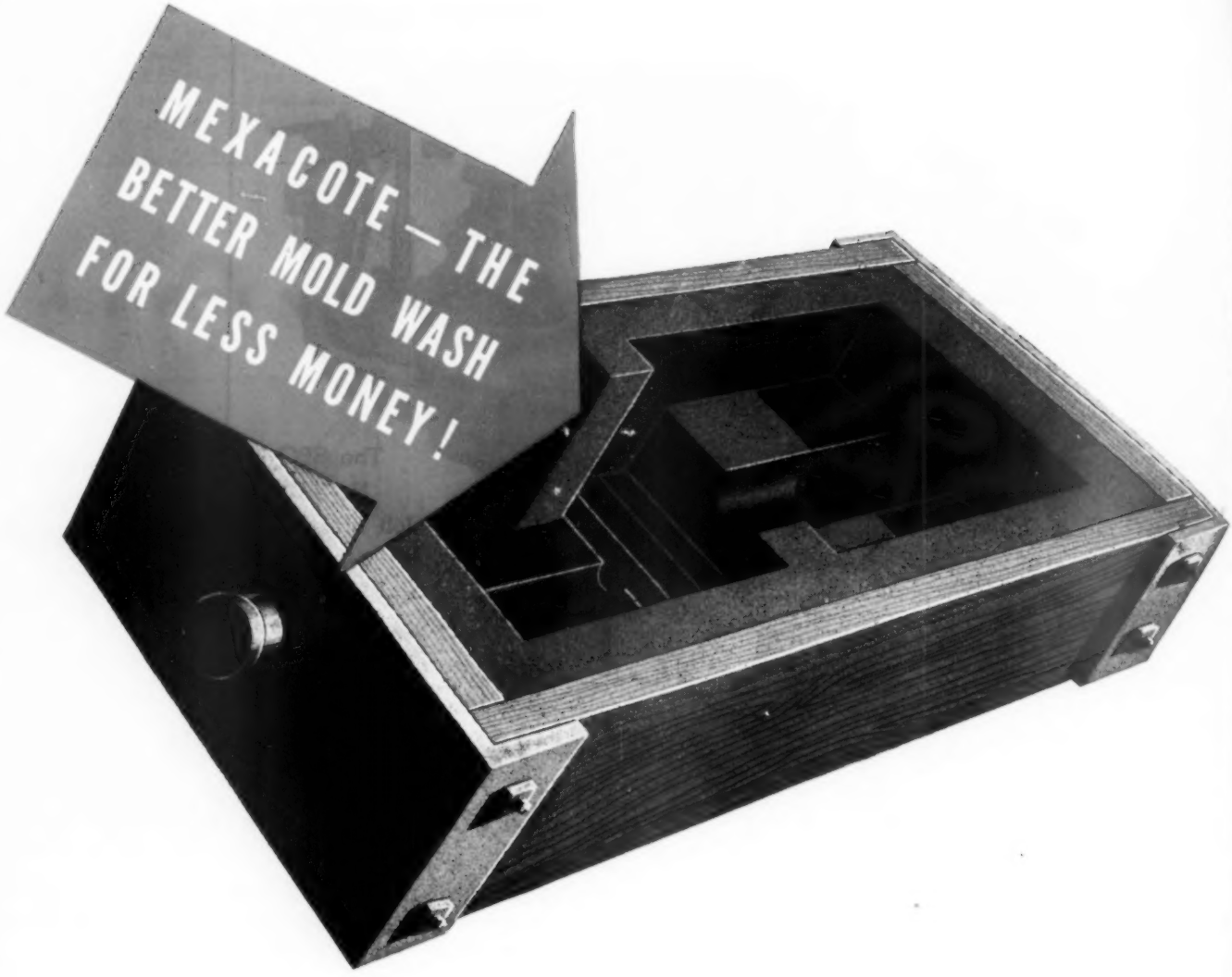

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TYPICAL BRINELL HARDNESS NUMBERS OF SOME NONFERROUS ALLOYS

Type Alloy	Condition	Cu	Sn	Zn	Pb	Al	Mn	Fe	Ni	Other	Brinell
Cu - deox.	Sand Cast	Rem								P 0.05	43
Cu-Al	Sand Cast	90.0				10.0					90-109
Cu-Al-Fe	Sand Cast	Rem				8.6		2.9			109-124
Cu-Al-Fe	Cent. Cast	Rem				8.6		2.9			116-131
Cu-Al-Fe	Sand Cast	Rem				9.0		3.0			100
Cu-Al-Fe	Sand Cast	Rem				9.5		1.0			115-126
Cu-Al-Fe	Cent. Cast	Rem				9.5		1.0			121-134
Cu-Al-Fe	Sand Cast	Rem				11.0		3.7			159-183
Cu-Al-Fe	Cent. Cast	Rem				11.0		3.7			166-187
Cu-Al-Fe	Sand Cast	Rem				14.1		4.5			321-352
Cu-Al-Fe	Sand Cast	89.0				10.0		1.0			92-96
Cu-Al-Fe-Mn	Sand Cast	Rem				7.18	0.58	0.62			69
Cu-Al-Fe-Mn	Chill Cast	Rem				10.0	3.0	3.0			159
Cu-Al-Fe-Ni	Sand Cast	Rem				10.0		5.0	5.0		170
Cu-Al-Mn-Fe-Ni	Sand Cast	Rem				13.5	0.5	4.0	1.0		300
Cu-Al-Ni	Chill Cast	Rem				10.0			5.0		185
Cu-Be	Quenched	Rem								Be 1.0	65-70
Cu-Be	Q. & aged	Rem								Be 1.0	125-130
Cu-Be	Cast	Rem								Be 2.2	109
Cu-Be	Q. & aged	Rem								Be 2.2	400
Cu-Be	Quenched	Rem								Be 2.4	110-130
Cu-Be	Q. & aged	Rem								Be 2.4	340-370
Cu-Fe	Sand Cast	Rem						50.0			130
Cu-Pb	Sand Cast	Rem	0.46		11.68	0.09				P 0.025	55
Cu-Pb	Chill Cast	Rem	0.16		12.66	0.09				P 0.027	38
Cu-Pb	Sand Cast	Rem	0.07		19.26	0.05					25
Cu-Pb	Chill Cast	Rem	0.07	0.15	20.94	0.13					26
Cu-Pb	Chill Cast	Rem	0.12		24.40	0.11				P 0.078	27
Cu-Pb	Sand Cast	Rem	0.24		26.33	0.10				P 0.064	23
Cu-Pb-Sn	Sand Cast	Rem	5.36	0.82	8.61			0.04	0.14	Sb 0.34 P 0.04	52
Cu-Pb-Sn	Sand Cast	Rem	9.91	0.29	9.81			0.05	0.18	Sb 0.28 P 0.04	64
Cu-Pb-Sn	Sand Cast	Rem	10.0		10.0					P 0.05	50-70
Cu-Pb-Sn	Sand Cast	Rem	8.0	1.5	15.0						45-65
Cu-Pb-Sn	Sand Cast	Rem	3.65	3.19	17.08						44
Cu-Pb-Sn	Chill Cast	Rem	3.52	3.43	17.50						52
Cu-Pb-Sn	Sand Cast	Rem	6.0	1.0	20.0						40-55
Cu-Pb-Sn	Sand Cast	Rem	9.76		20.10				0.62	Sb 0.14 P 0.03	60
Cu-Pb-Sn	Sand Cast	Rem	4.78		24.37					Sb 0.07	42
Cu-Pb-Sn	Sand Cast	Rem	2.0		35.0						28
Cu-Pb-Sn	Sand Cast	73.0	7.00		20.00			0.25			45
Cu-Pb-Sn	Sand Cast	78.0	7.00		15.00						48
Cu-Pb-Sn	Sand Cast	70.0	5.00		25.00			0.25			40
Cu-Pb-Sn	Sand Cast	81.0	7.00	3.00	9.00						50-55
Cu-Pb-Zn-Sn	Sand Cast	83.0	2.00	5.00	10.00						34
Cu-Ni	Sand Cast	54-56							44-46		75-85
Cu-Ni-Si	Sand Cast H.T. 840° F	Rem							2.5	Si 0.6	200
Cu-Ni-Sn	Sand Cast	Rem	5.0						5.0		75
Cu-Ni-Sn	Sand Cast w.q. aged 500°	Rem	5.0						5.0		136
Cu-Ni-Sn	Sand Cast w.q. aged 600° F	Rem	5.0						5.0		171
Cu-Ni-Sn	Sand Cast w.q. aged 500°	Rem	5.5						7.5		165
Cu-Ni-Sn	Sand Cast w.q. aged 650° F	Rem	5.5						7.5		213
Cu-Ni-Sn	Sand Cast w.q. aged 600° F	Rem	7.0						20.0		207

TYPICAL BRINELL HARDNESS NUMBERS OF SOME NONFERROUS ALLOYS

Type Alloy	Condition	Cu	Sn	Zn	Pb	Al	Mn	Fe	Ni	Other	Brinell
Cu-Ni-Zn	Cast	Rem		6.0	5.0				20.0		64
Cu-Ni-Zn	Cast	Rem	4.0	6.0	5.0				20.0		114
Cu-Ni-Zn	Cast	Rem	4.0	6.0					20.0		114
Cu-Ni-Zn	Sand Cast	Rem	4.0	10.0	5.0				20.0		120
Cu-Ni-Zn	Cast	Rem		18.44			0.16		21.28		57
Cu-Si	Sand Cast	Rem								Si 5.0	77
Cu-Si-Mn	Sand Cast	Rem				1.0				Si 4.0	80
Cu-Sn	Cast	Rem	1.0							P 0.03	40
Cu-Sn	Cast	89.65	9.75	Rem	0.15					Sb 0.10	62
Cu-Sn	Sand Cast	Rem	10.0								74
Cu-Sn	Chill Cast	Rem	11.2							P 0.23	108
Cu-Sn	Cast	Rem	6.94	2.73	7.14				0.24	P 0.04 Sb 0.50	53
Cu-Sn	Cast	Rem	7.0	3.0	3.0						50
Cu-Sn	Cast	Rem	10.0	1.50	5.0						60
Cu-Sn	Cast	Rem	14.0	0.25	1.0						85
Cu-Sn	Sand Cast	80	20							P - trace	136
Cu-Sn	Sand Cast	89	11								80
Cu-Sn	Sand Cast	89	10.5							P - 0.50	72-77
Cu-Sn	Sand Cast	90	10								65-70
Cu-Sn-Pb	Sand Cast	79.50	12.00		7.50					P 1.0	74-80
Cu-Sn-Pb	Sand Cast	84.25	10.00		5.00					P 0.75	60
Cu-Sn-Pb	Sand Cast	88.00	10.00		2.00						65-70
Cu-Sn-Pb	Sand Cast	79.75	10.00		10.00					P 0.25	65-70
Cu-Sn-Pb	Sand Cast	80	10.00		10.00						55-60
Cu-Sn-Pb	Sand Cast	84.0	9.50		6.50					P 0.20	59-61
Cu-Sn-Ni	Sand Cast	Rem	8.0						7.5		105
Cu-Sn-Ni	Sand Cast w.q. aged 500° F	Rem	8.0						7.5		179
Cu-Sn-Zn	Cast	Rem	9.89	2.09							55
Cu-Sn-Zn	Cast	Rem	10.0	2.0							60-80
Cu-Sn-Zn	Cast	Rem	10.16	1.88	0.28			0.03		As 0.41 Sb 0.013 P 0.007	61
Cu-Sn-Zn	Cast	88.00	10.00	2.00							70-75
Cu-Sn-Zn-Pb	Sand Cast	85.5-86.5	10.5-12.00	1.5-3.5	1.0		0.15	0.25			90-120
Cu-Sn-Zn-Pb	Sand Cast	88.00	8.00	2.00	2.00						57-59
Cu-Sn-Zn-Pb	Sand Cast	87.8-89.8	7.0-7.8	0.4-3.4	1.5-2.3						50-70
Cu-Sn-Zn-Pb	Sand Cast	90	6.50	2.0	1.50						50-60
Cu-Sn-Zn-Pb	Sand Cast	85	5	5	5						50-60
Cu-Sn-Zn-Pb	Sand Cast	89	5	3	3						40-45
Cu-Sn-Zn-Pb	Sand Cast	85.7-89.3	9-11	1.5-2.5	0.3-0.8						80-100
Cu-Ti	Cast H.T. 840° F	Rem								Si 0.3 Ti 0.8	78
Cu-Zn	Cast	Rem		30.2							55
Cu-Zn	Cast & Annealed	Rem		30.2							57
Cu-Zn	Cast	Rem		41.04							90
Cu-Zn	Sand Cast	55.0		45.0							80-98
Cu-Zn-Al	Cast	63.35		Rem	0.25	4.12	2.74	1.73	0.20		179
Cu-Zn-Al	Cast	Rem		31.45		4.10		1.45	3.00		159
Cu-Zn-Al	Cast	Rem		33.57		3.95			3.13		185
Cu-Zn-Al	Cast	Rem	0.75	34.68		3.28		0.15	2.83		154
Cu-Zn-As	Cast	Rem		29.41						As 0.49	58
Cu-Zn-As	Cast	Rem		40.54				0.07		As 0.48	80
Cu-Zn-Fe	Cast	56.85	0.32	Rem		0.23	0.20	1.50			93
Cu-Zn-Fe	Cast	57.75-58.25	0.2-0.5	38.5-39.5	0.20	0.50	Trace-0.25	1.05-1.35			100-140
Cu-Zn-Fe	Cast	56.0	0.75	41.5		0.50	0.25	1.0			109-119
Cu-Zn-Fe	Cast	56.0	1.0	41.0		0.50	0.50	1.0			104-119

(To be continued)

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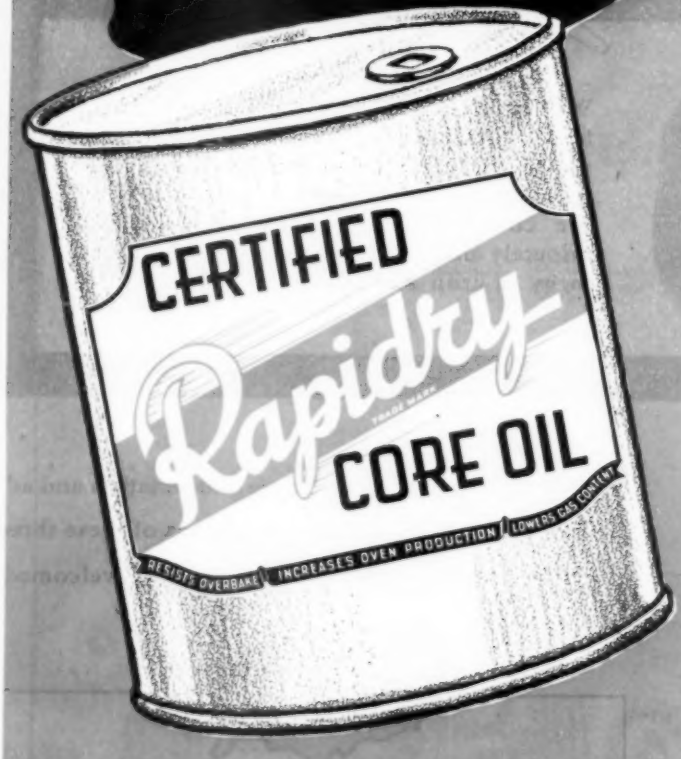

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Concluding Reports on

WISCONSIN CONFERENCE

Space limitations prevented publishing in the March issue reports on all technical sessions of the eighth annual foundry conference held by the Wisconsin Chapter, A.F.A. and the University of Wisconsin at Milwaukee, Feb. 8-9. Concluding reports are presented here.

TWO malleable sessions were devoted to discussion of modern annealing equipment in addition to one on melting, and another on material handling. Speakers at the meeting on annealing equipment included Walter Jaeschke, Whiting Corp., Harvey, Ill.; H. E. Scarbrough, General Electric Corp., Chicago, and C. H. Martin, Holcroft & Co., Chicago. Mr. Jaeschke stated that a recent survey of the malleable casting industry showed that periodic ovens far outnumber continuous ovens, and that pulverized coal is the most commonly used fuel. The survey also indicated that the pulverized coal fired, floor type periodic oven is used most commonly and accounts for 34.4 per cent of annealing capacity. Continuous ovens account for 27.5 per cent.

Mr. Jaeschke described details of construction and operation of the pulverized coal fired periodic ovens, and said that the typical annealing cycle for a 20-ton oven using packing material occupied 116 hours, of which 36 hours were required for heating to 1700 degrees Fahr., 30 hours holding time, 20 hours for cooling to 1400 degrees and 30 hours for cooling to 1250 degrees. Without packing material the time can be reduced about 24 hours.

Eliminate Packing Material

Mr. Scarbrough discussed electric annealing furnaces, and stated that they were made in batch and continuous types, and designed for use with protective atmospheres to eliminate the use of packing material. In the continuous type pusher mechanism or roller hearths may be used. First cost of roller type hearth is higher than for pusher type, but lighter trays for holding the castings can be used.

In batch type units those generally used for malleable annealing are the elevator type where the charge is placed on a car and elevated into the furnace. While the single chamber furnace is used, usual application is two chambers, one of which operates under much higher temperature than the other. In the latter arrangement the charge is placed in the high temperature unit and at completion of heating and holding time the charge is lowered, moved under the adjacent low temperature furnace, and elevated into it for completion of the cycle.

At the second malleable session M. E. McKinney, Hamilton Works, International Harvester Co., Hamilton, Ont., spoke on methods technique and co-ordination of malleable melting. He said that control must start at the stock piles of pig iron and scrap. In charging the furnace care should be exercised to see that each time the same proportion of heavy and light scrap is used. In calculating mixtures Mr. McKinney pointed out that losses in silicon and carbon varied from heat to heat, and described a system of leveling them by employing loss figures from the previous 5 heats.

Mr. McKinney stated that one of the main factors in melting control is the fuel-air ratio or the CO-CO_2 balance over the charge while melting down and while superheating. With powdered-coal firing the same blower gate and feed screw settings will not give the same balance at all times, so to insure uniform operation a continuous gas sampler and analyzer is attached to the furnace as well as a draft gage to indicate the pressure within the furnace.

Pack Test Bars in Pots

Close control also is required in annealing to secure the best results, according to Mr. McKinney. He uses test bars packed in pots located in strategic points in the ovens. These are examined after annealing, given a bend test, brinell hardness test, and inspected under the microscope for presence of pearlite and cementite. From those indications firing is adjusted on the next heat.

At the last malleable session Fred Pampel, Chain Belt Co., Milwaukee, pointed out that the long melting cycle in malleable foundries formerly interfered with plant mechanization, a condition which largely has been changed by the trend toward duplexing. As a consequence of the shift to continuous melting and pouring more effective use can be made of material handling equipment. Naturally, the foundry still employing batch melting must use a different approach in plant mechanization.

Mr. Pampel cited the various savings incident to mechanical handling of sand and molds but strongly urged that careful study be made of all departments before any mechanization program be attempted, since co-ordination is necessary to realize maximum benefits. In later discussion from the floor regarding advisability of shifting from batch melting to duplexing it was estimated that a minimum melt of approximately 4 tons per hour is necessary to warrant installation of equipment that will permit the latter procedure.

Two meetings were held on the technical phases of the foundry. At one J. A. Kayser, Laclede-Christy Clay Products Co., St. Louis, discussed the properties of refractories while at the other Dr. J. N. Mrgudich, Burgess Battery Co., Freeport, Ill., spoke on x-ray diffraction procedure. (Text of Mr. Kayser's talk appears in this issue, starting on page 113).

In the second session Dr. Mrgudich began his talk with brief descriptions of x-ray equipment, radiography, microradiography, and electronic microscopy, all of which, he pointed out, are related as they are shadowgraphs. Microradiography involves taking radiographs of thin sections which later are examined under the microscope, and permits determination of facts which cannot be found as easily and rapidly any other way. X-ray diffraction differs from radiography in that the x-ray beam is permitted to impinge on the surface of a metal or alloy and from which it is reflected at various angles depending upon the atomic arrangement. Photographs are made of those reflections which give information on the arrangement of the atoms in the space lattice diagram and numerous other facts.

One recent application of x-ray diffraction is its use in inspecting cast aluminum alloy cylinder blocks for airplane engines which must be free from porosity in certain internal passages extremely difficult to examine. X-ray diffraction proved an efficient, economical method of inspection. Application of the method also indicated that sandblasting under certain conditions after heat treatment tended to penetrate deeply below the surface resulting in nullifying to some extent the benefit of the heat treatment. Study of sandblasting conditions resulted in correction of the trouble by confining penetration to only a few thousandths of an inch.

Discuss Centrifugal Casting

Concluding session of the conference was a general meeting on centrifugal castings, with John Perkins, Ford Motor Co. of Canada, Windsor, Ont., the speaker. He described the practices followed in his foundry in producing a wide variety of steel castings by the process using sand and metal molds. Most of the sand molds are baked cores, but some work is being produced from green sand molds. Many castings are produced by the multiple mold or cluster method. Molds are spun counter clockwise at a speed of about 167 revolutions per minute.

Mr. Perkins gave considerable information on core sand used, the sand mixture as used in the molds or cores, composition of the core spray mixture, composition of the steel from which castings are made, etc. He said that centrifugal casting methods have numerous advantages including closeness of finished dimension and high yield of casting from metal poured.

All of the sessions devoted to pattern-

(*Continued on page* 148)

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Radiography has effected vast economies in materials, man-power, and machine time by eliminating defective parts before costly machining. A typical example:

Of 1500 simple aluminum housings—radiography found 18% unacceptable. Disastrous to the foundry? No! Radiography suggested better ways of casting. Rejections on many future deliveries dropped to less than 1%.

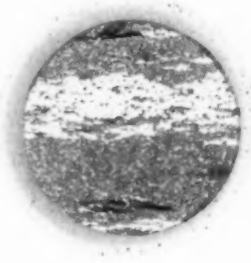
Or again, the case of a foundry which tried a very complex casting job which other foundrymen called "impossible":

A motor maker designed a new type lightweight crankcase with many desirable features . . . shrinkage at ports seemed insurmountable. X-raying successive castings led to successful technic . . . greatly enhancing the foundry's reputation.

Time after time—radiography, by showing what was wrong, has helped foundrymen make better castings . . . meet increasingly difficult requirements . . . build goodwill with foundrymen's customers throughout the world. For further information write Eastman Kodak Company, X-ray Division, Rochester 4, N. Y.

In addition to Radiography other photographic methods offer many advantages in the foundry.

Engineers, metallurgists, and production men are finding specialized photographic methods a great help in meeting today's requirements for rapid change-overs, redesigns, and modifications—speeding and increasing production, improving quality, and reducing costs... important now—more so in the days ahead.



MICRORADIOGRAPHY gives Valuable Data on Below-Surface Microstructure: Three-dimensional in effect. Reveals true shape of inclusions, and concentration change or distribution of elements, not otherwise visible.

SPECTROSCOPY for Quantitative and Qualitative Analysis: Makes possible testing of melt before pouring. Fast analysis improves quality... increases production by decreasing waiting time.

PHOTOMICROGRAPHY Investigates, Records, and Guides: A basic tool for microstructure examination. Helps set standards and check operations of processes involving changes in structure of material.

FUNCTIONAL PHOTOGRAPHY

Analyzes... Improves... Records... Reproduces

Kodak

(*Continued from page* 145)

making subjects were heavily attended. Paul E. Riedel, Production Pattern Co., Milwaukee, was chairman of the opening meeting at which problems in purchasing patterns were discussed. Paul Dunbleton, General Malleable Corp., Waukesha, Wis., described a specification form his company has been using in seeking bids on patterns. This form is intended primarily for use in purchasing matchplates and small patterns and makes it possible to indicate various specifications which it might be difficult to incorporate in the accompanying blueprint of the pattern. It has been found useful not only to the pattern buyer but also to the patternmaker.

Core blowing was the discussion subject at the second session of the pattern group, with A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee, presiding. A typical blower was displayed and the functions of its various parts were described. Mr. Pfeiffer cited comparative costs of making certain cores by hand and by machine, and described the experimental production of a centrifugal pump runner core on a blower. In making this core the use of blacking powder provided valuable information regarding the direction of the sand travel and assisted in the proper locating of vents in the corebox. This powder, placed in the box before the sand was introduced, is apparent in the blown core and indicates how the sand flows.

Rex Ford, International Harvester Co., Milwaukee, displayed and discussed a variety of cores, many of them of a complicated nature, which had been blown by machine. In subsequent discussion Jack Walsh, Kelsey-Hayes Wheel Co., Detroit, recommended use of 1 quart of turpentine per 500 pounds of sand to improve flowability of core sand in blowing, also use of 1 per cent iron oxide to

(*Concluded on page* 150)

Scenes at banquet and luncheon meetings during recent annual Wisconsin foundry conference. Photos courtesy of John Bing, A. P. Green Fire Brick Co., Milwaukee

PHILCO

gives you the latest in Modern Battery Design!

THOUSANDS of electric industrial trucks are now getting more work done at lower cost because of the advanced research of Philco engineers in developing tougher, more powerful storage batteries. Philco has long led in providing batteries of maximum capacity, with the rugged long-life construction especially engineered for today's heavier work schedules.

Now Philco engineering leadership is demonstrated anew with the storage battery that gives 30% longer life —the great new Philco "Thirty"! For lower cost in handling materials with electric trucks, be sure to include the new Philco "Thirty" in your plans. Now available in preferred types. Complete information gladly sent on request. PHILCO CORPORATION, *Storage Battery Division*, Trenton 7, New Jersey.

For 50 years a leader in Industrial Storage Battery Development

The new Philco "Thirty" with 30% longer life is identified by its distinctive red connectors.

(*Concluded from page* 148)

correct excess moisture.

Alfred M. Fischer, Chas. Jurack Co., Mliwaukee, presided at the third pattern session. In the discussion of pattern and foundry gadgets used to expedite production Mr. Fischer described the use of a vibrator mounted integral with large patterns, rather than as an accessory, as an aid in quicker and more efficient drawing. Among other so-called gadgets mentioned was a heating element attached to metal patterns which is said to facilitate the pattern's draw, and a pair of tongs used to set chaplets between cores in an otherwise inaccessible cavity of a mold.

Use of portable machines in the pattern shop has expanded markedly in recent years, it was pointed out by various speakers. M. F. Frankard, Delta Mfg. Co., Milwaukee, discussed the use of portable tools, such as jointers, band saws, jig saws, drill presses, etc., and explained the better efficiency they provide compared with a smaller number of large tools, particularly in the larger shops where men must wait their turn to use them if only a few are available. One company reported it was replacing several large tools in favor of small units spaced throughout the shop.

Wartime conditions present special problems to the pattern shop in enlisting apprentices, it was pointed out by J. McGill, Allis-Chalmers Mfg. Co., since prospective apprentices facing induction are interested primarily in maximum wages they can make before entering the armed forces. Better methods of selecting apprentices and improved training procedure were recommended by William F. Patterson, War Manpower Commission, as the most effective means of reducing the turnover in apprentice ranks.

The concluding pattern session was a joint meeting with the nonferrous and gray iron groups, with Mr. Pfeiffer presiding. It was devoted to discussion of the relation of casting design to pattern-making, and emphasized the necessity for co-operation between the designer of the casting, the foundry and the pattern shop in the interest of most efficient production of quality castings.

SALVAGING CASTINGS

By Impregnation with Resin

By H. W. FOELSCH
Lithgow Corp.
Chicago

IMPREGNATION of rejected castings with solutions based on phenolformaldehyde resins is of special interest to the manufacturer or user of brass, bronze, aluminum, and magnesium castings, since service requirements, especially in aircraft and electronic fields, usually include the property of pressure tightness without even the smallest continuous void. Ordinarily gray iron castings do not require air, oil or water tightness, but, in instances where it is necessary, impregnation has been of value. This is especially true in the fields of hydraulic machinery, rams and pressure cylinders.

Certain types of castings with thin walls in which air tightness must be complete may have very high percentages of rejects because of porosity. We have found it best to impregnate all of these castings even before testing, since this additional operation gives a very high percentage of usable units. We have found, too, that best results are obtained by impregnating castings after machining—for, in many cases, voids are opened up during the machining operation. Thus, these would not have been filled to provide leakproof castings had impregnation been carried on before the machining operations.

Pores may vary in diameter from capillary dimensions to 0.010-inch. Capillary pores are easily and completely sealed with one cycle. Larger pores are sealed with, at most, three cycles. The number of cycles is determined by treating an aliquot part with one cycle; another with two cycles; and still a third with three cycles. These aliquot parts are tested; and the satisfactory castings requiring the least number of cycles form the basis for production procedure. If, then, a small percentage of the castings treated in this manner are defective, they are returned for another cycle.

Equipment required for impregnating includes:

Retorts—Working pressure 100 pounds per square inch.

Compressor — Working pressure 100 pounds per square inch; free air 125-130 cubic feet per minute.

Vacuum Pump—Vacuum 26-28 inches of mercury.

Holding Tanks—275-500 gallons.

Blowing Tables—Fume hoods.

Washing Racks—Full drain with fume hoods.

Drying Tables—Fume hoods.

Oven—Maximum temperature 450 degrees Fahr.

Machined castings are inspected for cleanliness and flaws before being placed in the retorts. They are subjected to a vacuum of 26-28 inches of mercury for 30 to 75 minutes depending on the casting wall thickness. The impregnating solution is admitted into the retort without permitting the vacuum to drop more than 4 inches of mercury. When the castings are completely covered, as evidenced by sight-glass inspection or by an overflow pipe, the vacuum is released, and pressure (80 to 100 pounds per square inch) is applied and held for 1 to 3 hours, depending on the thickness of the casting and the penetration necessary.

Pressure then is released and the castings removed from the retort and allowed to drain for a short period. Air, under high pressure, is directed into corners, tapped holes, and designed crevices to remove residual resin solution. Washing, to remove excess coating from the machined surfaces, is accomplished with suitable solvents. Baking requires from 2 to 3 hours; it begins at approximately 175 degrees Fahr. and ends at 325 to 350 degrees Fahr. depending on the type of resin solution used in impregnating. This procedure is followed for as many cycles as necessary; then the castings are inspected and shipped.

Hollow castings too large for treatment in retorts can be sealed successfully by forcing the solution into the casting walls by internal pressure. All but two orifices in the casting are sealed either by cans or plugs, or by drilled plates and gaskets. The impregnating solution is forced into the casting through the lower orifice; and when the casting is properly and completely filled with solution, the exit port is closed and air pressure applied at the other orifice. The casting is inspected carefully for leaks.

Vary Number of Cycles

If the solution leaks through the walls shortly after full pressure is applied, it is likely that more than one impregnation is necessary. If no leaks occur, or if only small leaks are apparent, one cycle is usually sufficient.

Cleaning and washing are carried out as in the retort method. The time and temperature of the baking required will depend on the weight to area ratio of the casting involved.

Proper precautions should be observed in all phases of impregnating. Most of the solvents used are flammable and must be handled carefully. Fumes should be removed as efficiently as possible to prevent health hazards to the workmen, although the toxicity of the solvents used (alcohols, ketones, or esters) is not high. Fume hoods are necessary on the tables used in washing and drying the castings, and in blowing them out with air. These hoods should be large enough to prevent the escape of fumes. They require sufficient air velocity to handle all vapor-to-air proportions encountered. The danger of fire can be minimized by proper removal of fumes, by adequate instruction of the workmen in safety precautions, and by the isolation of the entire department. Certainly, smoking or flames in the vicinity are not to be tolerated.

Properly cured sealing resin is not affected by the elements, by acids, salts, solvents, or oils. Where pressure tightness is the only feature involved, treated castings are perfectly satisfactory and fulfill the purpose for which they were designed.

From an article in the October, 1944 issue of *Bakelite Review*.

¶ Do you want a Sand Cost as low as any in the foundry industry?

☆ ☆ ☆

¶ The answer is the use of Revivo Bond, which:

1. Is low in first cost.
2. Has higher durability than any other type of bond clay. *No foundry using any other type of clay can equal the low sand costs resulting from the use of—*

REVIVO BOND

¶ Ask us to prove this statement. Write for our descriptive bulletin on REVIVO BOND.

Remember, please, that ECP service engineers have *five* different bonding clays and their many combinations from which to give you the one right recommendation and to assure you of receiving the *most bonding strength per dollar.*

EASTERN CLAY PRODUCTS, INC., EIFORT, OHIO

ECP

DIXIE BOND • BLACK HILLS BENTONITE • REVIVO BOND • REVIVO SUPER BOND • BALANCED REVIVO

All TYPES OF BONDING CLAYS

A Foundry Sand Service Based Upon Practical Research

foundry DEVELOPMENTS

WHILE manganese bronze and aluminum bronze may be separated readily from other copper-base alloys by experienced sorters, there is considerable difficulty encountered in distinguishing those from each other—in fact so much so that separating aluminum bronze from manganese bronze mainly is guesswork. However, study of the problem by the Bureau of Mines led to the development of a simple spot test which can be performed easily and rapidly. Chemicals used are sulphuric acid and a mixture containing mercuric chloride, ammonium thiocyanate, silver nitrate and ammonium persulphate. Sulphuric acid solution is formed by adding 1 part concentrated acid (sp. gr. 1.84) to 2 parts water by volume. The other is made by dissolving 4 grams mercuric chloride and 4.5 grams ammonium thiocyanate in 50 cubic centimeters of water, and then adding 0.01-gram silver nitrate and 0.75-gram ammonium persulphate. In operation a small amount of the sulphuric acid is *sprayed* on the clean piece of bronze to be examined, and then 1 drop of the mercury-silver-ammonium compound applied. Manganese bronze gives a characteristic grayish-purple spot while aluminum bronze shows a greenish-yellow spot.

♦ ♦ ♦

PRACTICAL test made in various foundries in England indicate that a leaded gun metal containing approximately 7 per cent tin, 5 per cent zinc, 5 per cent lead, and remainder copper with or without nickel, is more adaptable to production of pressure-tight castings of variable section than other lead-free or low-lead content alloys such as those containing copper 86, tin 12, zinc 2 per cent; copper 88, tin 10, zinc 2 per cent, and copper 86, tin 7, zinc 5, lead 2 per cent. According to an article by Frank Hudson published in *Journal* of the Institute of Metals (London), August issue, the 83-7-5-5 alloy has a bursting strength equal to the other alloys, and much higher when 3 per cent nickel is added. The alloy has better bearings properties and wear resistance for the majority of hydraulic applications than 88-10-2.

♦ ♦ ♦

ALLOY steel for castings which must have minimum yield strengths from 950,000 to 150,000 pounds per square inch and minimum reduction of areas from 40 to 30 per cent contains 0.28 to 0.32 per cent carbon, 1.35 to 1.50 per cent manganese, 0.50 to 0.55 per cent molybdenum, and 0.09 to 0.12 per cent vanadium. To obtain the 150,000 pounds per square inch minimum yield and 30 per cent minimum reduction of area the castings are water quenched from 1600 degrees Fahr., and drawn at 1150 degrees Fahr. To obtain the 95,000 to 105,000 pounds per square inch minimum yield with 40 per cent minimum reduction of area they are quenched from the same temperature (1600 degrees) and drawn at 1240 degrees Fahr.

♦ ♦ ♦

ELECTROMAGNETIC radiation from the spark unit in spectrographic laboratories often interferes with the satisfactory operation of the densitometer. However, according to *Spectrographer's News Letter* published by Harry W. Dietert Co., Detroit 4, the elimination of that source of interference can be accomplished easily since the radiation is entirely from the high voltage cables. Remedy is to obtain a length of flexible galvanized steel conduit about 1 foot shorter than the cables. Inside diameter should be at least 2 inches to accommodate both cables. Thread both cables through the conduit after removing fiber plugs. Plug cables back into source unit and into spark stand. Arrange conduit to cover as much of cables as possible. Ground conduit securely to source unit cabinet with sheet metal screw or conduit strap. Ground other end to spectrograph base.

♦ ♦ ♦

VEXING problem of radiographing light-metal aircraft parts which varied over a wide range of thickness from small thin parts to those which were thick and of considerable size was overcome by installing two enclosed cabinet-type x-ray units over the conveyor line. Machines were spaced with respect to trays loaded with parts to be inspected. One machine makes an exposure for heavy density parts as the other makes a simultaneous exposure for thinner areas.

♦ ♦ ♦

DUE TO the desire of maintaining carbon pick-up at the minimum the bed of the cupola used in a malleable duplexing operation was kept as low as possible. That resulted in production of a high iron oxide slag which eroded the cupola lining to such a degree that considerable relining had to be performed at short intervals. Since operating conditions could not be changed, experiments were conducted to see what might be done to reduce lining attack as much as possible, and it was found that the addition of 20 pounds of sand per ton of metal alleviated the condition considerably.

♦ ♦ ♦

NOVEL arrangement for making up charges for electric furnaces at Otis Elevator Co., Buffalo, is described in a recent issue of *Whiting Founder*. It consists of an elevated steel loading platform with a funnel opening in the center. Platform is located outside and adjacent to the main foundry, and under the yard crane so that the operator can make up the charges with a magnet. Charges fall into cylindrical, bottom drop bucket on a weighing car. The latter is used to transport bucket to a point inside the foundry where it can be picked up by a crane, and discharged into the furnace.

♦ ♦ ♦

ONE patternmaker has developed a procedure for increasing the height of risers on patterns which works out successfully. First step is to build the riser up with modeling clay. Then a plaster mold is made over that and the pattern section involved. Plaster mold is dried in the oven. Riser is tinned carefully, and the plaster mold set in proper position after drilling a hole through its top to act as a gate. Aluminum is poured into the mold, and when it meets the tinned riser, an excellent bond is secured.

♦ ♦ ♦

BONDING agent now in wide use in the investment molding process was developed a number of years ago by combining ethyl alcohol and silica. It is a liquid with the somewhat formidable name of tetraethyl orthosilicate. Presumably its sister compound ethyl silicate may be used similarly since both hydrolyze with dilution and addition of a small amount of hydrochloric acid to form ethyl alcohol and silica. The alcohol evaporates leaving the silica to form the bond.

♦ ♦ ♦

CHROMIUM deposits of considerable thickness can be plated directly on aluminum and its alloys through application of a preplating process requiring only a few seconds. Aluminum is cleaned, passivated, immersed in the preplating solution for a few seconds, and then electroplated in the usual manner. It is claimed that adherence is good, and that torsion, heat, corrosion resistance and weathering tests have shown up well. E. B.

CROWN HILL

SEACOAL FACING

BLACK MAGIC?

Well, not exactly, although the performance of Federal's Crown Hill Seacoal is amazing. To vent the mold quickly is the primary function of a seacoal—that's why Crown Hill is made from selected high volatile, quick-flash coal. At the same time, low sulphur content eliminates hard spots in castings caused by sulphur pickup. The fusion point of the little ash residue left is 2980° F.—molten iron can't fuse it. Castings peel easily and cleaning costs come down. Try it in your foundry and you'll understand why it is becoming so popular with foundrymen everywhere.

CROWN HILL MEANS QUALITY SEACOAL

THE FEDERAL FOUNDRY SUPPLY COMPANY

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Seacoal Plant CROWN HILL, W. VA. • CHICAGO • CHATTANOOGA, TENN. • DETROIT • MILWAUKEE • NEW YORK • ST. LOUIS • RICHMOND, VA. • Mines UPTON, WYO.

IN TWIN CITIES: The Foundry Supply Co., Inc., 2295 University Ave., St. Paul 4, Minn. IN SOUTHWEST: Beaumont Cement Sales Co., Houston & Beaumont, Texas, and Harvey, La.

You win with BOTH THESE BONDS

INVEST in War Bonds first. Then invest in MOGUL, because it helps you realize the goal of every foundry man . . . steady profitable production with minimum discards.

MOGUL is a perfect Green Bond, which increases permeability in cores. Use MOGUL in cores for both green and dry strength.

MOGUL works with core oil; it decreases drying time and yields smooth cores. MOGUL works perfectly with pitch or resin, too, because cores can be handled while still warm. MOGUL is widely used with sharp sands.

KORDEK

KORDEK is a perfect DRY BOND which can be used in smaller quantities than most dry binders. KORDEK produces better castings with fewer discards.

CORN PRODUCTS SALES CO. 17 BATTERY PLACE NEW YORK 4, N. Y.

activities of foundry GROUPS

Central Ohio

AT A dinner meeting of the Central Ohio Chapter of the A.F.A., held Jan. 16 at the Fort Hayes Hotel, Columbus, O., Jack Lathrop of THE FOUNDRY was the coffee speaker and gave an interesting report on a survey of the anticipated equipment needs of the foundry industry.

"Fundamentals of Synthetic Sand" was the subject discussed by N. J. Dunbeck, Eastern Clay Products Inc., Eifort, O. Mr. Dunbeck opened his talk with a few remarks on the nature of bond. He stressed the point that sands and clays are deposited by natural classification, and it is therefore extremely difficult to find deposits which combine all the desired properties. It is much easier to compound synthetic sands from the more plentiful deposits of relatively pure sands and clays than to find the chance deposits which are compounded by nature to meet the exact quality for particular conditions.

Outlining the comparative advantages and disadvantages of natural and synthetic sands, the speaker stated that either directly or indirectly, the use of synthetic sands can be boiled down to economics. They have the disadvantages of fast drying, narrow workable moisture ranges, and the requirement of more equipment, but their durability, ease of control and flexibility, coupled with metallurgical advantages, make them cheaper to use. Mr. Dunbeck closed his talk with a few points on the selection of clay. In the discussion period that followed members cleared up many of their individual problems in the use of synthetic sand.—*Frank Kiper, secretary.*

Western Michigan

FEB. 12 meeting of the Western Michigan Chapter of the A.F.A. was held at the Hotel Ferry, Grand Haven, Mich., with 85 members and guests in attendance. It was National Officers' Night, and the chapter was honored to have as its guests, Ralph Teetor, national president, and Norman Hindle, director, technical development program.

Mr. Teetor spoke briefly on the need for dissemination of technical knowledge and the keen competition the industry can expect after the war.

Mr. Hindle discussed what he and his co-workers plan to do to enlarge the technical services of the association. Plans include the education of designers, the publishing of handbooks on such subjects as molding sand, cupola operation, and solidification and design, and the establishment of a technical library to feature bibliography and abstract service to members. An attempt will be made to persuade universities to revise their foundry courses and to start promotion to publicize the industry.

M. R. Scott, Linde Air Products Co., Detroit, discussed flame cutting, flame gouging, and oxyacetylene cutting, as practiced in steel foundries. Slides were used, which included the showing of a 60-inch cut at the rate of 3 inches a minute, with a large torch.—*C. H. Cousineau, program chairman.*

Texas

FEB. 8 marked Patternmakers' Night of the Texas Chapter of the A.F.A., with 75 members and guests attending the meeting at the Rice Hotel, Houston. The customary fine steak dinner was served. E. T. Kindt, president, Kindt-Collins Co., Cleveland, gave an outstanding talk on "The History and Future of Patternmaking." Chairman F. M. Wittlinger presided.

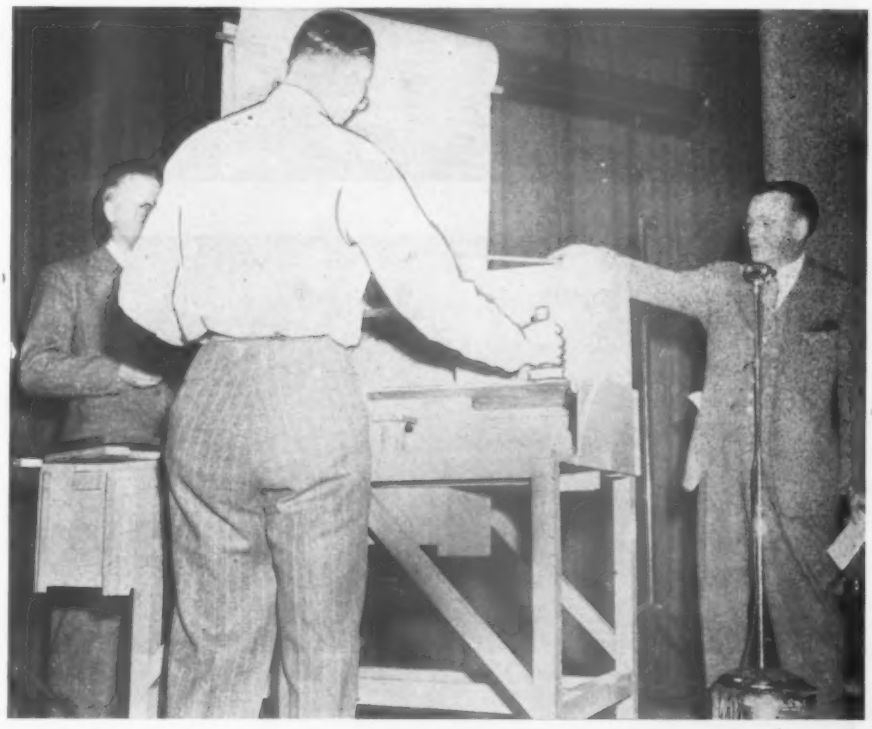
Mr. Kindt took the patternmakers to task for their laxity in research in the fields of new materials and methods, and for their persistence in clinging to old, obsolete machines. According to statistics compiled by the speaker there is only one patternmaker per hundred thousand population in the United States, and pattern shops are slow in developing new patternmakers. The talk was supplemented by the showing of a film demonstrating some of the equipment manufactured by Mr. Kindt's company.

April 12 meeting of the chapter will be held in Lufkin, Tex.—*Leroy G. Stenzel, publicity chairman.*

Canton

MEMBERS of the East area of Canton District Chapter of the A.F.A. were hosts at the meeting held Feb. 15 at the Elks Club, Alliance, O., with 80 members and guests in attendance. The clubhouse, the former Morgan home, afforded a background for a thoroughly enjoyable evening.

Discussion groups were held covering current problems of venting of cores and molds, pattern design and its relation to production, and cast iron inoculants. The subject of steel was directed by G. W. Simes, American Steel Foundries Inc., Alliance; pattern designs, by David T. Born, American Steel Foundries; non-



MOTION STUDY: *James H. Smith, general manager, and Stuart D. Martin, production manager, Saginaw Malleable Iron Division, General Motors Corp., Saginaw, Mich., presented their demonstration of "Better Methods and Motion Study" before the Chicago chapter, A. F. A., Feb. 5* (THE FOUNDRY, March 1945, *p.* 148). *Mr. Martin makes simple cores while Chapter Secretary Frank E. Wartgow (left) holds a stop watch, and Mr. Smith (right) explains motion sequence*

ferrous, by M. G. Winters, Winters Foundry & Machine Co., Canton; and cast iron, by K. F. Schmidt, United Engineering & Foundry Co., Canton.—*George M. Biggert, secretary.*

Quad-City

QUAD-CITY Chapter of the A.F.A. held one of the largest meetings of the season Feb. 19, at the Fort Armstrong Hotel, Rock Island, Ill., with 94 members and guests in attendance, including visiting engineers and buyers. Chapter chairman R. E. Wilke presided. A coffee talk, "Operation of Mississippi River Locks and Dams," was given by A. F. Burleigh, U. S. Engineers, Rock Island.

Speaker for the evening was A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee, whose subject was "Pattern and Casting Engineering." Mr. Pfeiffer displayed 20 models of castings, and outlined the importance of using such models for all complicated jobs which are to be placed in the foundry. Through the use of this method, he stated that much greater co-operation is obtained between the foundrymen, patternmakers and engineers.

One of the important items stressed by the speaker was that most buyers should realize the importance of supplying first-class pattern equipment to the foundries, as the added cost of better patterns is easily saved through higher quality and lower cost of castings. The need of core checking templates for good foundry practices was also outlined.—*H. L. Crepe, secretary-treasurer.*

Chesapeake

CHESAPEAKE Chapter of A.F.A. held its annual session on brass and bronze Feb. 23, at the Engineers Club, Baltimore. Speaker of the evening was W. J. Laird of the Westinghouse Electric & Mfg. Co., East Pittsburgh, who gave a very interesting and enlightening paper covering investigations on "The Relation of Strength to Section in Sand Cast Brass and Bronze."

Mr. Laird discussed experiments conducted by his company on silicon bronzes, Navy brass, high-strength brass, Navy "G" brass and phosphorus bronze, and the effects of section size of these materials, when cast under proper conditions, on the strength; also the corresponding results obtained using standard sand cast test bars.

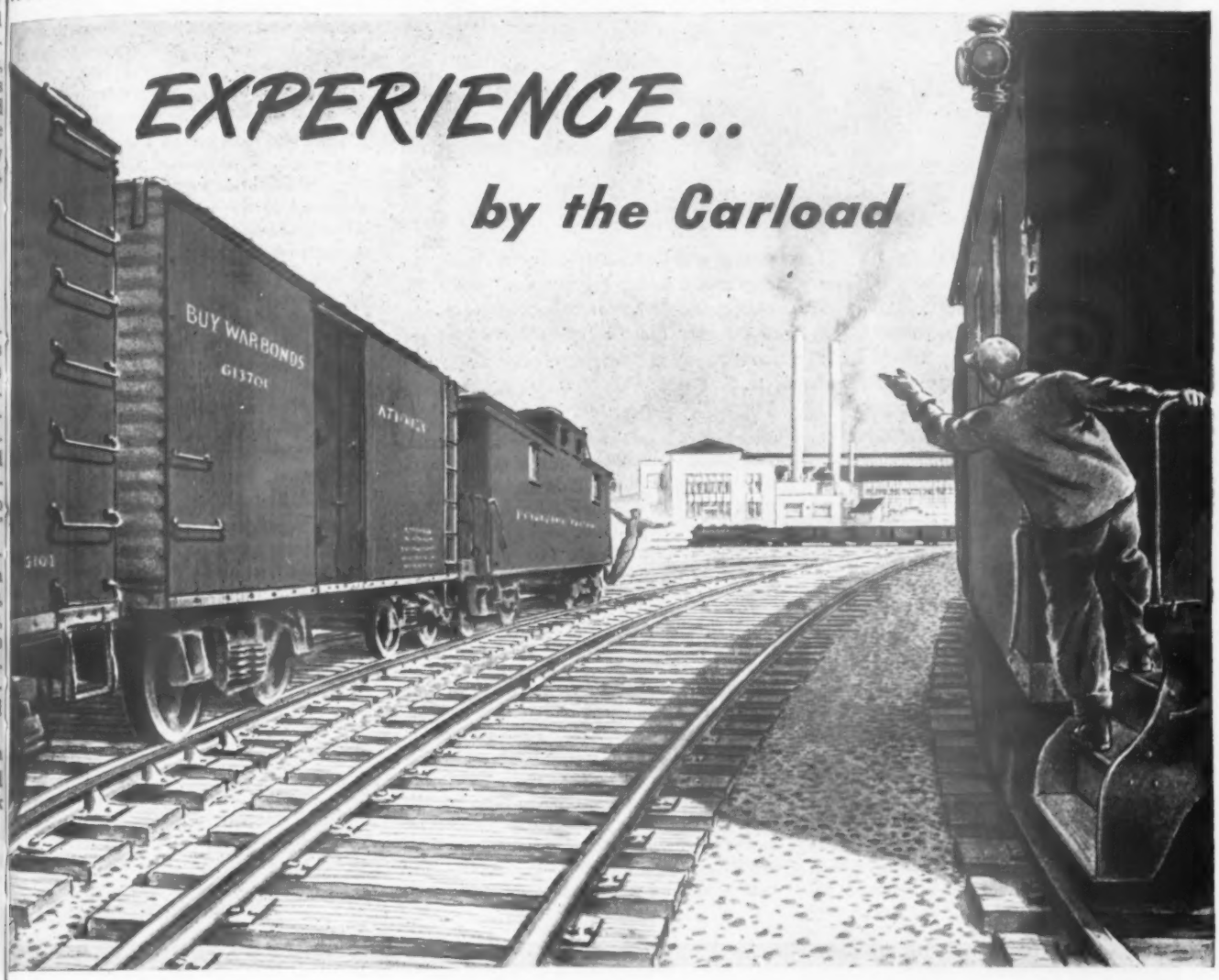
Dr. B. M. Loring, Naval Research Laboratory, Anacostia, D. C., added paralleling information covering work

(*Continued on page* 158)

CANTON DISTRICT: *Alliance, O., was the site for the February meeting of the Canton District Chapter, A.F.A. Accompanying views, top to bottom, show: Part of the attendance at dinner; the nonferrous discussion group; steel group, and gray iron group*

Number 8 of a Series: "Looking at the 5 essential things you never see in electrodes!"

EXPERIENCE...
by the Carload



SIXTY YEARS of accumulated manufacturing experience taught us exactly what materials make the best electric-furnace electrodes. Experience guides the minds, hands and machines within National Carbon plants.

That's why "Experience . . . by the carload!" aptly describes the flow of raw materials and finished electrodes in and out of National Carbon Company plants.

Manufacturing experience has helped to nearly cut in half the price of "Acheson" graphite electrodes in twenty years. "National" carbon electrode prices have also been greatly lowered. Yet you have continued to get stronger, more uniform electrodes of higher current capacity . . . and ever-lower cost per ton of electric-furnace output.

A complete explanation of this steady improvement in product performance lies in all five of the *essential things you never see,* but which are present, in every "National" and "Acheson" electrode: Manufacturing experience, selection of raw materials, continuing research, manufacturing control, and customer service.

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KEEP YOUR EYE ON THE INFANTRY . . . THE DOUGHBOY DOES IT!

PATTERNS AND CASTINGS: *Recent meeting of the Quad City Chapter, A. F. A., in Rock Island, Ill., featured a talk on "Pattern and Casting Engineering" by A. F. Pfeiffer, Allis-Chalmers Mfg. Co. View at the speaker's table shows, left to right: C. E. Von Luhrte, Chicago Retort & Fire Brick Co.; Mr. Pfeiffer; R. E. Wilke, chapter chairman; Maj. Frank W. Ashton, U. S. Engineers; C. H. Burgston, program chairman; A. F. Burleigh, U. S. Engineers*

(*Continued from page* 156)

now under investigation at the Naval Research Laboratory.

The Chapter chairman, H. A. Horner, Frick Co., announced that membership of the chapter has reached 225 members.—*E. J. Hubbard, reporter.*

Northeastern Ohio

ONE of the best turnouts of the season —more than 230 members and guests—marked the March 8 meeting of the Northeastern Ohio Chapter, A.F.A. It began with an open-house inspection of the training facilities of the Cleveland Trade School in the afternoon which was attended by a large group of foundrymen and vocational school directors and instructors from other schools in the district. The latter were dinner guests of the chapter at the Cleveland Club, and heard brief talks by J. H. Redhead, Lake City Malleable Co., Cleveland, and D. C. Courtright, Cleveland Trade School.

Mr. Redhead spoke on "The Foundry Offers an Opportunity to Youth" pointing out the importance of the industry in relation to every day life as well as in war, and the advantages it offers to youth of vision. Mr. Courtright talked on "Training Youth for Foundry Opportunity" and described the vocational arts system in Cleveland where the boys are given exploratory courses beginning in the junior high schools. In the technical high schools they are given opportunity to specialize. In the trade or vocational school the boys are given 2-year courses in foundry and patternmaking in which they spend half the time on shop practice and related work, and half the time on mathematics, English and similar work. Then they are placed in industry, and return to school on a part-time basis for 2 years. At the end of that time on completion of the required work they are granted diplomas.

Principal speaker at the technical session was C. E. Westover, Grede Foundries Inc., Milwaukee, who discussed "Wage incentive in the foundry." He stated that labor is the largest single item in the cost of castings, and reaches the proportions of equalling the sum of all the other costs combined. Hence, accurate relationship between labor cost and productivity should be determined. According to the speaker, wage incentive is a plan wherein the value placed on performing a given piece of work is expressed in a time study standard. Basic measure in that plan is time, a stable measure for worker, production, equipment materials, methods and planning.

Mr. Westover then explained the various factors entering into a wage incentive plan, pointing out that time study breaks the job down into elements and finds the time required for doing those elements. From numerous studies of similar elements, standards of time are developed for doing those elements. The standard elements are made into tables, and since every job is a combination of elements, a standard of time for performing a job can be established. Mr. Westover showed sections of motion picture films to illustrate his remarks and gave figures to show how the plan worked out as to wages and productivity. Following

(*Continued on page* 160)

TRAINING FOUNDRYMEN: *Open-house at Cleveland Trade School for city teachers and members of Northeastern Ohio Chapter, A.F.A., was part of chapter's March meeting program*

The top charge feature of the Moore Rapid Lectromelt Furnace offers these advantages:

INCREASED PRODUCTION OF QUALITY STEELS AND IRONS.

QUICK CHARGE BY DROP BOTTOM BUCKET.

CHARGING BUCKET CAN BE LOADING WHILE FURNACE IS MELTING PREVIOUS HEAT.

LESS TIME LOSS BETWEEN HEATS.

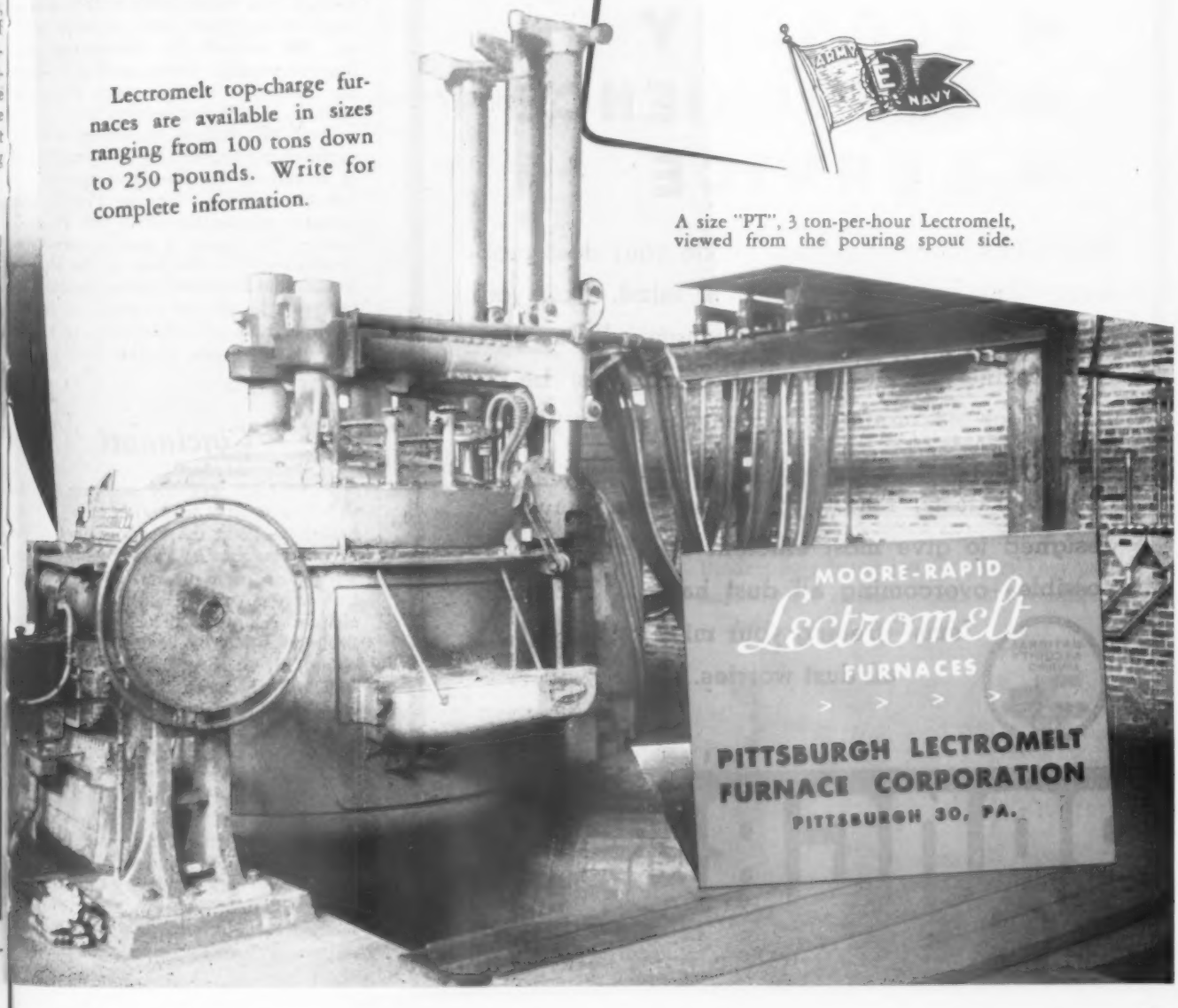
LARGE, BULKY SCRAP CAN BE USED.

Top charging is practical and efficient because of Lectromelt's simplified design and construction, in which complicated operating mechanisms have been avoided. The large range of operations possible with Lectromelt is an important factor to consider. In addition, large or small heats may be made as desired or part of the heat may be taken out and the analysis of the remainder altered as required.

Lectromelt top-charge furnaces are available in sizes ranging from 100 tons down to 250 pounds. Write for complete information.

why *Lectromelt* top-charge *Increases Foundry Production*

A size "PT", 3 ton-per-hour Lectromelt, viewed from the pouring spout side.



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When Pangborn engineers tackle your dust problems—they have three goals in mind. First your needs must be answered as economically as good engineering dictates. Next, the job must be arranged for maximum convenience, both in placing of collector and arranging for easy unloading of collected dusts. Finally, the installation must be designed to give most efficient operating service possible—overcoming all dust hazards and problems—freeing your mind of all dust worries.

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PANGBORN

WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

(*Continued from page* 158)

his talk a lively discussion ensued.

President Russell Lincoln appointed a nominating committee to select officers and report at the next meeting in April. The committee includes Bruce Aiken, Crucible Steel Castings Co.; William C. Manwell, Fulton Foundry & Machine Co.; Fred Stewart, National Malleable & Steel Castings Co.; Vincent J. Sedlon, Master Pattern Co.; Arthur J. Tuscany, Foundry Equipment Manufacturers' Association and E. J. Metzger, Wellman Bronze & Aluminum Co.—*Edwin Bremer, reporter.*

Philadelphia

FEBRUARY 9 meeting of the Philadelphia Chapter of the A.F.A. was held at the Engineers' Club, Philadelphia, with 75 members and guests in attendance. John W. Juppenlatz, Lebanon Steel Foundry, Lebanon, Pa., was speaker of the evening, and Philip G. DeHuff Jr., Westinghouse Electric & Mfg. Co., acted as technical chairman.

Mr. Juppenlatz described the various methods for non-destructive testing of castings, mentioning Magnaflux, X-ray, and Zyglo Light. With Zyglo equipment he demonstrated how effective this method is in determining surface defects after castings have been properly treated. He warned that foundrymen will have to produce better castings to meet the challenge of the rigid inspection methods now being employed.

Over 300 students, including molders, coremakers, apprentices and executives of foundries, are attending the weekly lectures sponsored by the Philadelphia Chapter at the University of Pennsylvania. The course is proving very successful and it is the aim of the chapter to continue advanced courses in succeeding years for the development of foundry supervisors and technicians, to supply the urgent needs of the foundries.—*B. A. Miller.*

Cincinnati

REGULAR monthly meeting of the Cincinnati Chapter of the A.F.A., held Feb. 12 at the headquarters of the Engineering Society, Cincinnati, had an attendance of approximately 100 members and guests. William A. Rengering, chapter chairman, presided. Lawrence Pridmore, International Molding Machine Co., Chicago, in his talk on "Core Blowing," discussed the various types of core blowing equipment available, and traced the history of the development of this method of making cores.

By use of slides the speaker illustrated the diaphragm type of machine and the various types of core boxes that can be used in the blowing of cores. There was considerable discussion concerning the method of venting and injecting sand in the core boxes. There are many different methods in use, and there was quite a difference of opinion among the members

(*Continued on page* 162)

KRAUSE Truscor (Light Weight) AND Amerikor (Heavy Weight) CEREAL BINDERS

PROCESSED TO PERFECTION ★ PROCESSED TO PERFECTION ★ PROCESSED TO PERFECTION ★

PROCESSED TO PERFECTION ★ PROCESSED TO PERFECTION ★ PROCESSED TO PERFECTION

QUICK MIX — BLENDS WITH ALL BINDERS

Truscor and Amerikor mix QUICKLY with all other types of binders. Schedules can be stepped up.

NO STICKING—INCREASED PRODUCTION

Truscor and Amerikor don't stick to the box — cores slip out "free and easy." You save time.

GREATER GREEN STRENGTH—NO SAG

Truscor and Amerikor Cereal Binders give greater green strength especially with the sharp sand used to produce open cores. Save core oil.

BETTER PERMEABILITY —LESS SCABBING, ***Cold Shut or Buckling***

Truscor and Amerikor Cereal Binders produce more open cores with greater permeability. They burn out faster, more completely . . . cut scabbing, cold shut and buckling to a new low.

BETTER FLOWABILITY —UNIFORM RAMMING

Truscor and Amerikor mixes maintain the flowability of the sand. Result . . . *reduced* scrap, metal penetration and porous surfaces.

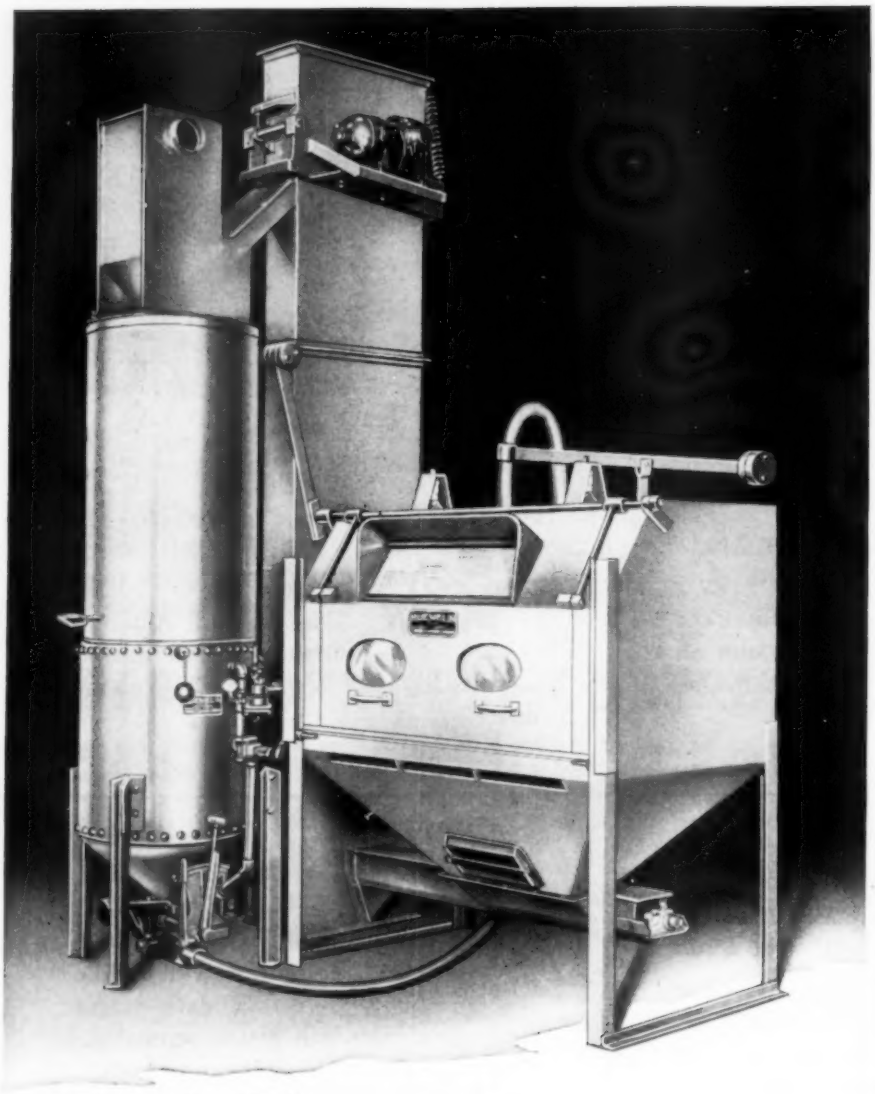
QUICKER SHAKE-OUT —SAVES TIME

From start to finish, Truscor and Amerikor Cereal Binders do a better job for you. They bake faster in the ovens . . . burn out completely . . . help you get more done.

PROCESSED TO PERFECTION ★ PROCESSED TO PERFECTION

• The high uniform quality of Truscor and Amerikor Cereal Binders are the result of Krause methods — proper selection of grain, care in manufacture, complete laboratory control and plenty of "know-how." Get a trial lot from your distributor.

★ WORLD'S LARGEST MILLERS OF DRY CORN



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Write for Bulletin 32-B.

Also manufacturers of Welding Fume Collectors, Abrasive Handling Systems, Cloth Dust Filters, Blast Rooms, and accessories.

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3850 NORTH PALMER STREET **MILWAUKEE 12, WIS., U. S. A.**

RUEMELIN

SAND BLAST EQUIPMENT · TUBULAR DUST FILTERS

(*Continued from page* 160)

as to which methods are the best. Mr. Pridmore pointed out many of the pitfalls, and offered suggestions as to the approach in making cores by this method. The factors of air pressure, sand mixes, venting and the type of sand injectors were thoroughly discussed.—*J. Schumacher, secretary.*

Eastern Canada and Newfoundland

GROUP discussions on "Molding Practice, Gates and Risers" were featured at the February meeting of the Eastern Canada and Newfoundland Chapter, held in the Mount Royal Hotel, Montreal. As usual, the groups attracted a large number of foundrymen anxious to air their views.

George Turnbull was chairman of the Cast Iron group. Discussion leaders were William Bradley, who spoke on molding sands, and James McCallum, who outlined the relationship between pouring temperatures and sound castings. William Bond and Edward Jennings discussed successful methods used in the production of some complicated bronze valve castings. Pressure pouring without risers was emphasized, although the use of different types of risers and chills was discussed at great length.

Ernest Tyler was chairman of the Steel group. Discussion was largely centered around the use of special risers such as the William's head, Washburn core and graphite rods. Preliminary talks were given by Charles Hacker and Robert Hale.

Henry Louette, chairman of the educational committee, spoke briefly on the lecture course scheduled for February and March. An attendance of 125 to 150 was anticipated.—*G. Ewing Tait, publicity chairman.*

Detroit

AT THE meeting of the Detroit Chapter of the A.F.A., held Feb. 15, at Rackham Memorial, 108 attended the dinner and about 25 more were present for the ensuing production roundtable conferences on brass, steel and aluminum.

Following the dinner Fred Melmoth, Detroit Steel Casting Co., gave a very interesting talk on his recent mission to England. General conditions were covered, but for security reasons not much could be given about the foundry status.

The brass group drew the largest crowd, 59 assembling to hear H. L. Smith, Federated Metals Division, American Smelting & Refining Co., Perth Amboy, N. J., discuss the effects of water vapor, carbon reaction and temperature in brass and bronze melting. J. P. Carritte Jr., True Alloys Inc., was discussion leader for the group.

G. A. Timmons, Climax Molybdenum Co., addressed the steel group and presented some interesting data on the iso-

(*Continued on page* 165)

...and on the home-front

B&W INSULATING FIREBRICK STOOD UP UNDER FIRE WITH "PRACTICALLY NO MAINTENANCE"

The year Poland was invaded, a mid-western foundry rebuilt its annealing furnaces.

That was a long time ago . . . when "Dunkerque" was only a provincial place-name. Before "Pearl Harbor" became a slogan and a challenge.

Throughout this whole period . . . since 1939 . . . these mid-western furnaces have operated continuously, on a 50-hour cycle, at a temperature of 1730 F. The B&W Insulating Firebrick installed in these furnaces the year Poland fell are still in service and according to the user, have required practically no maintenance.

This is just one of many examples of the low cost of B&W I.F.B. on a life-term or service-year basis.

Your local B&W Refractories Engineer will gladly give you other cost-reducing data on these remarkable firebrick.

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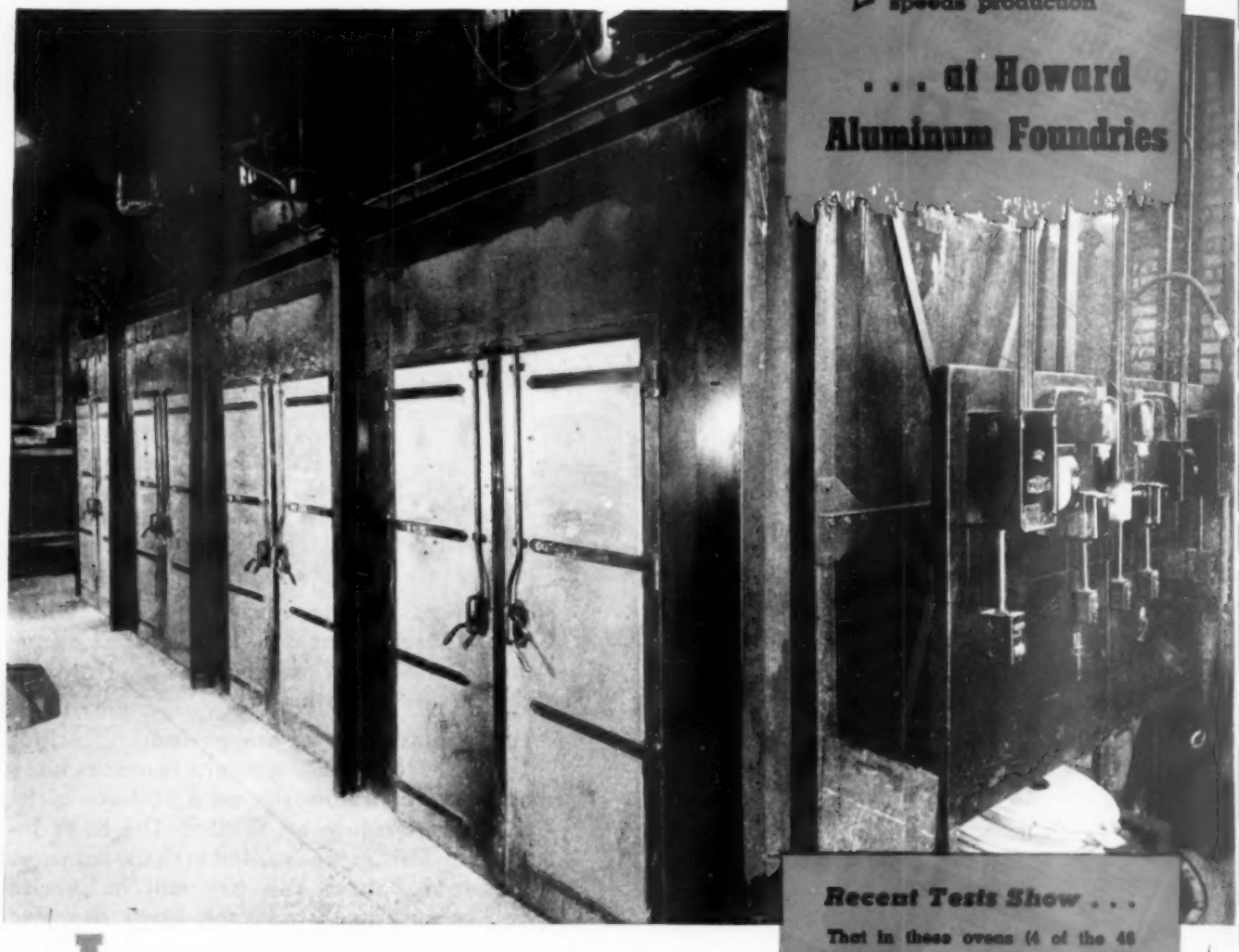
BATTERY OF

4 MAEHLER CORE OVENS

- reduces baking time
- produces more evenly baked cores — no green or burned cores
- speeds production

. . . at Howard Aluminum Foundries



INEFFICIENT core ovens can play havoc with your production schedules as well as your operating costs. Maehler re-circulating air heat ovens can help you keep these important factors in line. The re-circulating air heat principle, originated by Maehler, assures you of *perfect* heat uniformity resulting in more uniformly baked cores, elimination of core loss and shorter baking time.

The installation shown above at the Howard Aluminum Foundries, is an example of how today's top-flight foundries are using Maehler ovens for faster core baking. These Maehler gas-fired units handle the baking of the largest cores in three hours at 450° F. (These cores measure about 31 inches square, 10 inches deep through center and 4½ inches deep around edges.)

Maehler core and mold ovens are available in a complete range of gas fired, oil fired and electrically heated units for producing better, more evenly baked cores — faster at less cost. Call a Maehler engineer today or write for latest bulletins.

THE PAUL MAEHLER COMPANY
2200 W. Lake Street, Chicago 22, Illinois

Recent Tests Show . . .

That in these ovens (4 of the 46 Maehler units at the Howard Foundries in Chicago) cores for aluminum castings are baked with a maximum degree of uniformity. One of the ovens accommodating 8 large cores (31 inches square) on 2 large racks requires one hour and five minutes to reach a temperature of 450° F. It requires only three hours of baking time at this temperature. Reports show that temperature uniformity is virtually perfect.

MAEHLER

Industrial Ovens and Furnaces for Core Baking, Mold Drying, Heat Treating, Enameling etc.

(*Continued from page* 162)

thermal treatment of steel castings and the metallurgical principles involved, supplementing his talk with lantern slides and chalk talk. An enthusiastic group of 48 participated in the discussion, under the leadership of G. Vennerholm, Ford Motor Co.

The aluminum group had as speaker Vaughan Reid, City Pattern Foundry & Machine Co., who reviewed the design and manufacture of pattern equipment for high production foundries. A. W. Stolzenburg, Aluminum Co. of America, was discussion leader for the group of 30 members and guests attending this roundtable.—*Arthur H. Allen, secretary.*

Northern California

JOINT meeting of the Northern California Chapter of the A.F.A. and the Golden Gate Chapter of the American Society for Metals was held Feb. 19 at the Engineers' Club, San Francisco, with 150 in attendance. Victor P. Beauchamp, chairman of Golden Gate Chapter, A.S.M., and Ralph C. Noah, president of Northern California Chapter, shared honors in the conduct of the meeting, as there is a cross membership in the two chapters.

Samuel D. Russell, a national director of the A.F.A. introduced the national secretary, Robert E. Kennedy, on his first trip to the Pacific coast. Mr. Kennedy gave a short history of the organization and advised that with J. P. Hoehn, Enterprise Engine & Foundry Co., San Francisco, and a former director of the association, he planned to visit the formal installation of the new Portland, Oreg. chapter of the A.F.A. and present the association's baby rattle to the new chapter. Mr. Hoehn would present the new chapter with a miniature molding flask and hand rammer to be used as a block and gavel, made of lignum vitae at his foundry, the compliments of Northern California Chapter.

John E. Wilson, Climax Molybdenum Co., was speaker of the evening, presenting his subject, "The Tensile Properties of Cast Steel," supplemented by the use of slides. The discussion was interesting and instructive to all.—*Richard Vosbrink, publicity chairman.*

Rochester

APPROXIMATELY 75 members and guests attended the meeting of the Rochester Chapter of the A.F.A., held at the Hotel Seneca, March 8. Chapter president Walter F. Morton presided, and after the dinner, introduced the speaker, Thomas E. Barlow, Battelle Memorial Institute, Columbus.

Mr. Barlow's talk on "Ladle Inoculation," proved to be extremely interesting. He pointed out with emphasis the purpose, effect and limitations of inoculants, classifying them into two distinct types, graphitizing and stabilizing, and stressed

(*Continued on page* 168)

Morton's SALT TABLETS

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It's the exceptional industrial plant that fails to provide salt tablets for its employees. Only a few years ago it was otherwise. Salt Tablets have become an industrial "must" for men who work — and sweat.

Sweat robs the body of vital salt. This throws the body fluids out of balance. The result is Heat-Fag, inalertness, accidents, heat prostrations. The preventive is salt and water — water to restore the moisture lost in sweat, salt to restore the saline balance. Water alone won't do it. Both are needed.

The easy, simple, sanitary way to provide salt to workers who sweat is Morton's Salt Tablets available at every drinking fountain. The cost is less than a cent a man per week.

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800 Tablet size - - $3.25

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Morton's Salt Tablets are available either plain or with dextrose.

Case of 9,000, 10-grain salt tablets - - - - - - $2.60

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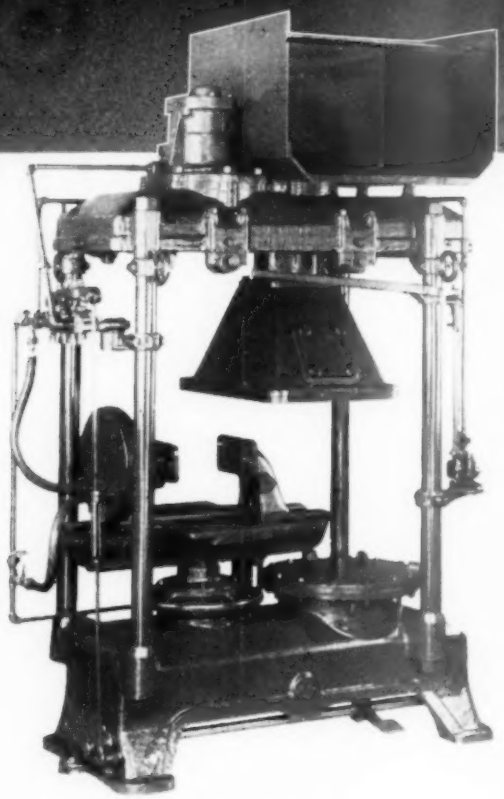
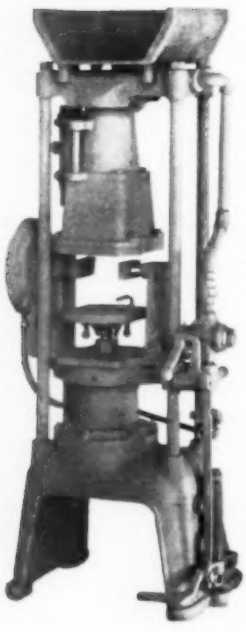
INTERNATIONAL *Sand Blowers*

are designed for Speed in Operation, Ease of Handling, and for the making of BETTER CORES.

There is an INTERNATIONAL Sand Blower to fit your every need. A call will bring an INTERNATIONAL Service Man with wide foundry experience to help you solve your core making problems.

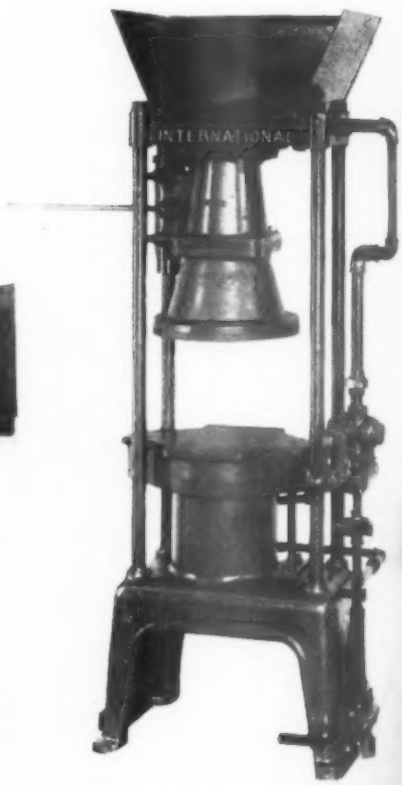


Type SB12—Adapted for large split boxes.

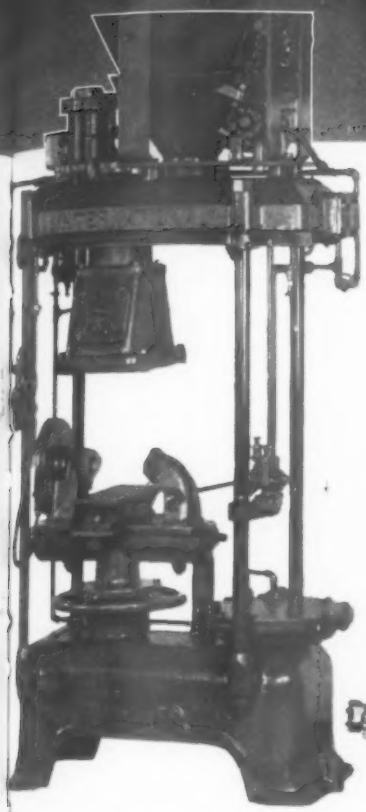


Type SB5 Sand Blower, adapted especially for small vertically split boxes.

Type SB11—For medium sized cores with air clamp and draw feature.

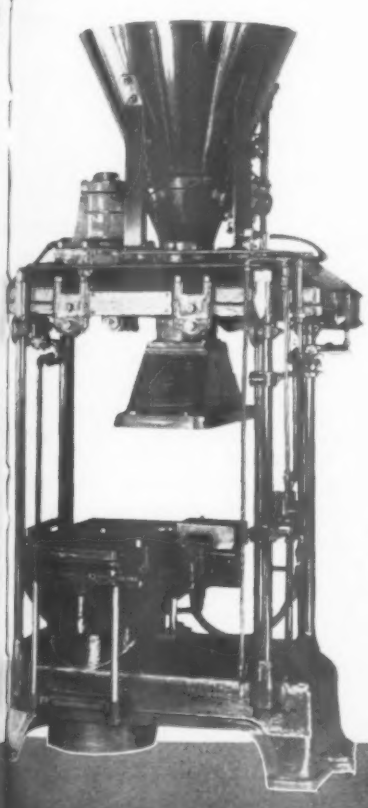


Type SB7 Sand Blower, adapted especially for small horizontally split boxes.

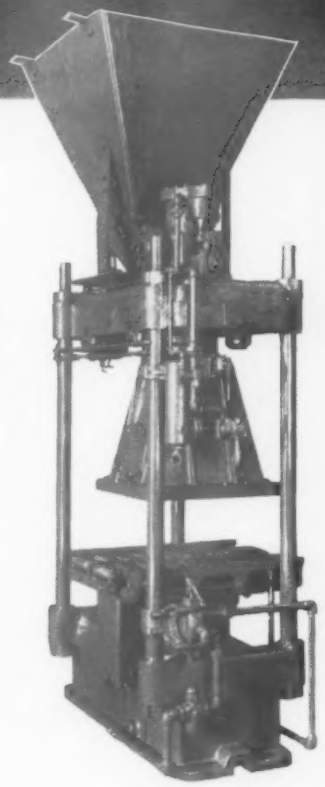


Type SB10—Sand Blower, adapted especially for medium size split boxes.

Type SB13—Sand Blower adapted especially for horizontally split boxes of medium size, but larger than can be handled by the **SB11** machine. May be had with the roll-out conveyor feature for ease in handling large core boxes.



Type SB15-H is adapted for the making of extra large Cores. Hydraulic clamp and draw feature.



Type SB17-H Sand Blower is the right machine for blowing those Super-Cores weighing up to 350 lbs.

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(*Continued from page* 165)

that inoculants differ from alloys, and should not be confused with them. Inoculants depend for their success on microstructure, as distinguished from alloys, which affect the chemical composition. The effect of inoculation may be lost if metal is held more than 10 to 15 minutes before pouring.—*Donald E. Webster, chapter reporter.*

Chicago

THIRD in the season's series of roundtables occupied the Chicago chapter, A.F.A., at its regular meeting at the Chicago Bar Association, March 5. Popularity of this type of meeting was demonstrated by the excellent attendance.

A promising future for gray iron castings was painted by A. J. Edgar, technical advisor, Gray Iron Founders' Society, Washington, in addressing the Gray Iron division roundtable on "Practical Gray Iron Foundry Problems." L. A. Colangelo, foundry metallurgist, Tractor Works, International Harvester Co., served as chairman.

Mr. Edgar commented that gray iron frequently is referred to as a single material, whereas it is actually a whole family of materials in the metals system, and is not unlike the spectrum which is a family of colors. It is an engineered metal to fit the requirements of an application, and can be made to embrace tensile strengths ranging from 20,000 to 60,000 pounds per square inch. To supply an engineered material, control of the metal is important. Each cast must be subjected to a chill test, and the foundry itself must be under close technical control.

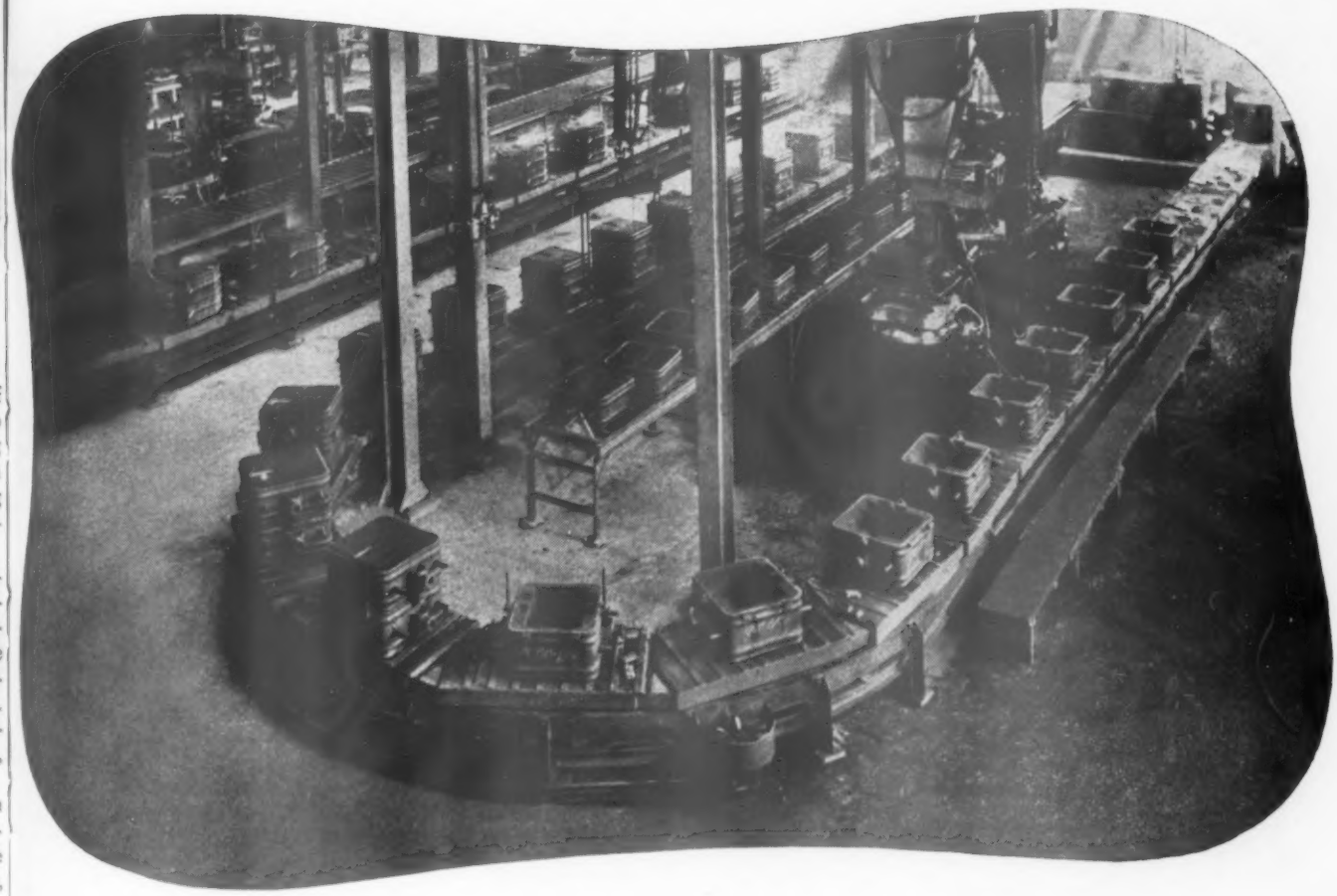
Asserting that competition of materials after the war is going to be keen, Mr. Edgar emphasized that the foundry is not a dying industry. Broad markets will be available, and the potential will be greater than formerly known in peace. As an example, he said it is estimated 1,620,000 tons of gray iron will be required for automobiles alone.

Steel division and Pattern division met jointly to discuss patterns. Martin Rintz, superintendent, No. 2 foundry, Continental Foundry & Machine Co., East Chicago, Ind., was chairman, and Lave G. Gustafson, assistant superintendent, same company, was the speaker.

"Magnesium Foundry Control" was the subject for the Nonferrous division roundtable, with Oscar Blohm, chief metallurgist, Hills-McCanna Co., as the speaker, and R. F. Thomson, metallurgist, Dodge Chicago Plant, Chrysler Corp., as chairman.

Norman F. Tisdale, metallurgical engineer, Molybdenum Corp. of America, Pittsburgh, addressed the Malleable division roundtable on "Boron and Its Effects Upon Physical Properties and

(*Continued on page* 170)



These Curves Have Angles Too

Traveling in an endless loop past the molding stations, the pouring zone, along the cooling run to the shakeout, and back to the molders again, Bartlett-Snow continuous mold conveyors enable foundry owners and plant managers to get a maximum of both quantity and quality from their plants. Individually engineered to your own particular plant requirements, Bartlett-Snow foundry equipment reduces the number of defectives, increases output, reduces costs, minimizes labor difficulties by giving the workers a larger take home pay, easier. And smoother, more continuous production returns increased profits, larger dividends to you. Can we send you more detailed information?

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FOUNDRY SAND, MOLD AND CASTINGS HANDLING

Save WITH JIB CRANES

on Point-of-Operation Jobs . . .

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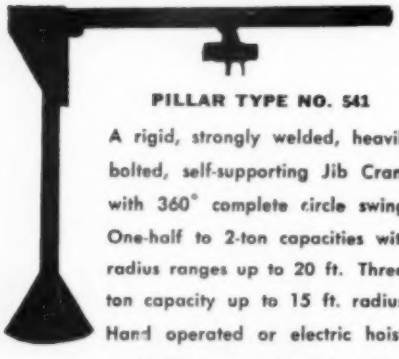
Through the simple expedient of installing a Jib Crane at this heat-treating point of operation, one man is able to lower the container into a pot type furnace. Then, with extreme ease, the container may be lifted and swung around to the oil drench at the left. There are other points of operation in foundries where Jib Cranes will speed handling, save on help and reduce costs.



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A rigid, strongly welded, heavily bolted, self-supporting Jib Crane with 360° complete circle swing. One-half to 2-ton capacities with radius ranges up to 20 ft. Three-ton capacity up to 15 ft. radius. Hand operated or electric hoist.

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at the "SHAKE-OUT" . . .

Operating at 360° complete circle swing, these nimble cranes take the load from overhead cranes which converge at the "shake-out". No costly tie-up or wear and tear of heavy duty equipment and you save man-power in the bargain.

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(*Continued from page* 168)

Annealing Characteristics." W. D. McMillan, works metallurgist, McCormick Works, International Harvester Co., was chairman.

The chapter's annual general meeting will be held April 2 and will feature as the speaker David M. Nichol of the *Chicago Daily News*, for the past two years Moscow correspondent, and at present a member of the foreign service staff in Chicago. A writer of many years experience in Europe, he will speak on "Russia As I See It."

Saturday evening, April 14, has been designated for Ladies Night, with the main ballroom of the Stevens hotel as the place. Facilities are available for over 1000 attendance.—*Erle F. Ross.*

Michiana

IN SPITE of dangerous driving conditions, over 100 members and guests were present at the meeting of the Michiana Chapter of the A.F.A., Feb. 6 at the Hotel LaSalle, South Bend, Ind. The guest speaker, E. W. Claar, Eastern Clay Products Inc., Eifort, O., in his talk on "Synthetic Molding Sands," first listed the silica sands and clays commonly used and explained the outstanding properties of these materials. He then pointed out how a molding sand can be made to fit almost any foundry's requirements by combining silica sands and clays having the required characteristics.

The speaker gave many helpful examples of combinations that would be suitable for producing various types of castings. Examples of sand difficulties and how they had been corrected by changing the type or amount of bonding materials were related by Mr. Claar from his own experience and were very helpful. He was careful to emphasize certain limitations of synthetic sands, especially in foundries not equipped to mix them properly. Questions and discussions brought out many points of special interest to those present.

W. V. Johnson, chairman of the entertainment committee announced that a Ladies' Night dinner party will be held early in April.—*C. W. Petersen.*

Pittsburgh

ONE of the most important jobs facing the foundry industry today is that of selling its product to the potential customer as well as to that customer's customer, the general public. Most foundries deal only with industrial firms and not with the ultimate consumer, with the result that they are not much interested in getting across the true story of the foundry's importance in our everyday life, according to Arthur J. Tuscany, executive secretary, Foundry Equipment Manufacturers Association, speaking at the February meeting of the Pittsburgh

(*Continued on page* 172)

HOWARD craftsmen and facilities are available to produce quality wood and metal patterns.

HOWARD craftsmen thoroughly understand foundry practices.

HOWARD patterns are engineered to fit your foundry requirements.

HOWARD modern facilities include two three-spindle type Keller Duplicators which are available for all types of metal duplicating work.

HOWARD FOUNDRY CO.

Pattern Division

General Office 4900 Bloomingdale Ave.

CHICAGO 39, ILLINOIS

. . . for Many Foundry Uses

MAHR SAFETY TORCHES

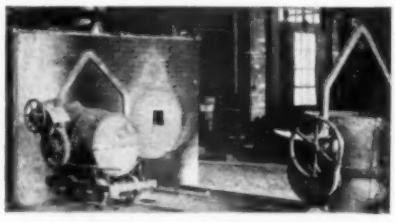
No. 101

Lights instantly without pre-heating. In 5, 15, and 20 gal. tank capacities.

You'll find a Mahr Safety Vacuum Torch on the job wherever intense, direct heat is required. You can't beat it for skin drying—it handles easily, does the job thoroughly and in a hurry.

It's also used for cupola lighting, because it throws a large, steady flame into the cupola breast opening, and gives a roaring fire quickly. And for ladle heating, any bracket or rigid support will hold torch while flame is directed into ladle.

You get complete combustion in the Mahr double chamber nozzle. Requires no pressure, since torch employs the vacuum principle—eliminating hazards of pressure torches. Burns kerosene, distillate, or low grade fuel oil.



Drying Relined Ladles.

This is a convenient way to install torch for drying relined ladles, or pre-heating for pouring. Our engineers will supply you with drawings of this permanent wall-type installation. Other types also available.

Write for Bulletins on OTHER MAHR PRODUCTS

Core ovens — Mold ovens
Portable mold dryers
Sand conveyors — Vibrating screens
Annealing furnaces
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Complete Engineering Service

MAHR
ENGINEERS • DESIGNERS • MANUFACTURERS
ALL EQUIPMENT FOR METAL HEATING

MAHR MANUFACTURING CO.
DIVISION OF DIAMOND IRON WORKS, INC.
1709 North 2nd St., Minneapolis 11, Minn.

(*Continued from page* 170)

Foundrymen's Association.

One result of the lack of a selling job in prior years is the present difficulty in securing adequate manpower for the foundries. Another was the comparative indifference of Army and Navy engineers toward castings in military equipment in the early months of the war. A better understanding generally of the way the foundry works and the range of castings it can produce is a definite necessity if the industry is to prosper and grow after the war.

Joint action on the part of members of the industry is necessary, according to the speaker, in order to maintain what we now have. Complete co-operation, and an effort backed up not only by lip service but by money and effort, will be necessary to meet the increased competition not only from other methods of fabrication in metals but also competition from new materials for the castings market.—*Robert L. Hartford*

St. Louis

MONTHLY meeting of the St. Louis District Chapter of the A.F.A. was held March 8, with 85 members and guests in attendance. C. F. Rohlkoetter, American Steel Foundries, East St. Louis, Ill., was the speaker. Mr. Rohlkoetter spent approximately 8 years with various railroad companies as material inspector prior to his association with American Steel Foundries as chief inspector. In view of this, his subject, "Inspection of Steel Castings," was well received.

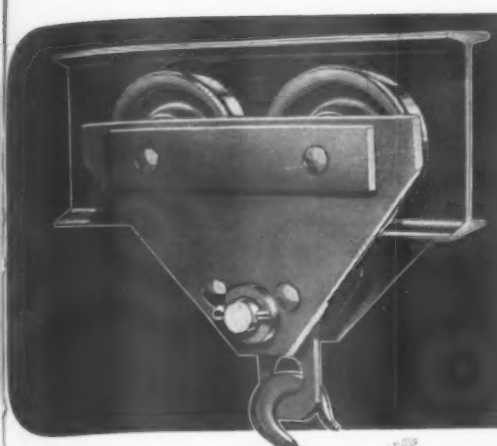
The speaker brought out in his talk that there was much to be desired in working out a satisfactory method of inspection. Magnaflux, X-ray and radiography have proved helpful in the inspection of castings at his plant and since some of them go to parts of the world where the temperatures are considerably below zero, these castings are being inspected at sub-zero and room temperatures. An interesting discussion followed the talk.—*Charles E. Rothweiler, secretary-treasurer.*

Southern California

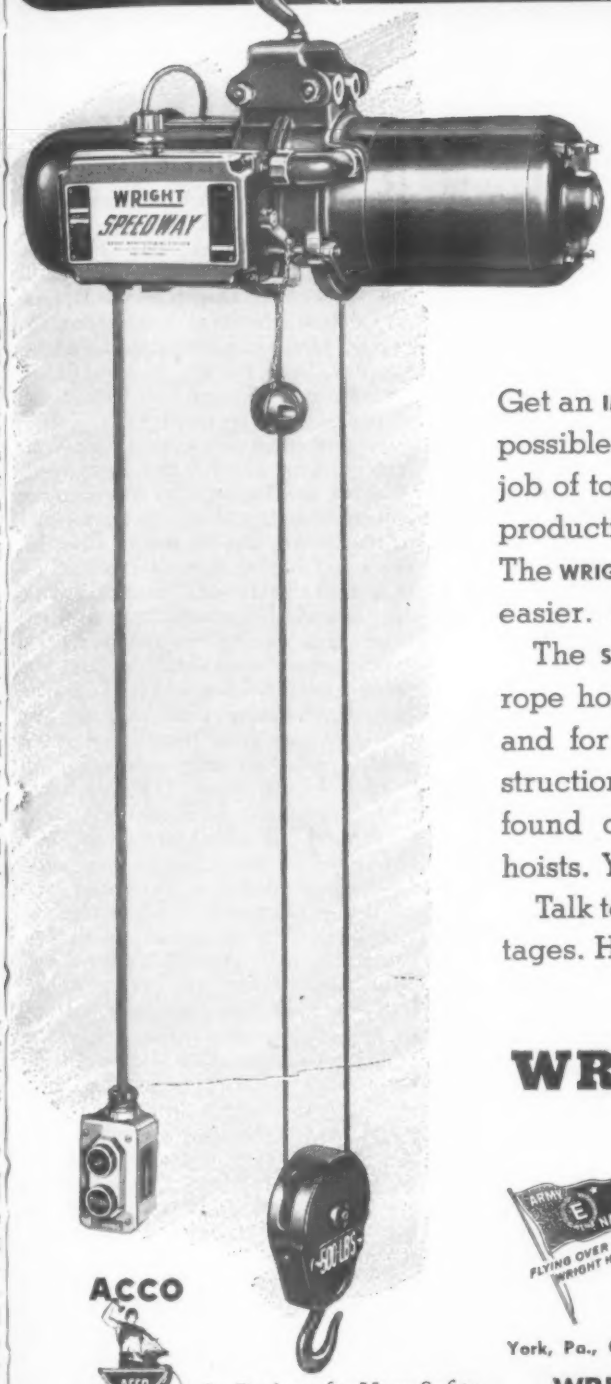
NATIONAL Officers and Past Presidents' Night" was featured at the meeting of the Southern California Chapter of the A.F.A., Feb. 16, at the Clark Hotel, Los Angeles.

Robert E. Kennedy, national secretary, Samuel D. Russell, a national director, and Charles Hoehn, a former national director, traced the development of the national organization from its beginning in 1896 to its present membership, numbering 29 chapters. Keynote of the discussion might be called the "crystallized consciousness" of foundrymen to the value of their trade organization, now nearing its national golden jubilee, as a clearing-house for ideas. Speakers stressed that the spectacular growth of foundry operations brought about by the war has

(*Continued on page* 174)



...SPEED IS ESSENTIAL TODAY ...AND TOMORROW



..THE SPEEDWAY IS WRIGHT

Get an **IMPROVED WRIGHT SPEEDWAY ELECTRIC HOIST** as soon as possible—not only for the help it will be in the hurry-up job of today, but for the necessary speed and lowered production costs it will afford both now and tomorrow. The **WRIGHT SPEEDWAY ELECTRIC** speeds up work, makes jobs easier. It saves labor time, cuts handling costs.

The **SPEEDWAY ELECTRIC** is a sturdy, lightweight, wire rope hoist, designed for fast lifting on assembly floors and for general use. Designed with spur gear construction, magnetic control and mechanical features found only in the more expensive production-type hoists. Yet it is priced economically low.

Talk to your **WRIGHT** distributor about **SPEEDWAY'S** advantages. He is listed in your classified telephone directory.

WRIGHT SPEEDWAY HOISTS

ARMY E NAVY
FLYING OVER THE WRIGHT HOIST PLANT

ACCO
TRADE MARK
In Business for Your Safety

York, Pa., Chicago, Denver, Los Angeles, New York, Portland, San Francisco

WRIGHT MANUFACTURING DIVISION

AMERICAN CHAIN & CABLE • BRIDGEPORT

Best Production Ever Recorded!

That was the unqualified verdict on Cortland Grinding Wheels, after another decisive War Production Test . . . Snagging operations in a large steel foundry in Pennsylvania were going from bad to worse — until Cortland Wheels were tested competitively against the brand then in use, with the following conclusive results:

WORK: Snagging gates and risers from castings.
Material: Hard, dense steel alloy rolls.
Machine: Fox Grinder, Swing Frame.
Wheel Speed: 8500 SFPM.

RESULTS: Competitive wheels removed gates from an average of 250 rolls. Previous high record had been 350. A Cortland Wheel, Type 1, of exactly the same size, removed 580 gates — "best production ever recorded," our sales engineer was proud to report. As a result, Cortland Wheels were made standard in the foundry.

In the extremely wide range of Cortland's abrasives, bonds, grains and wheel-types there's a combination that will solve every snagging and grinding problem *the one best way* . . . that will do *your* work faster, better and with greatly increased production per wheel.

Our engineers "know the combinations." Call on us any time — without obligation — for a practical, worth-while demonstration of new ways to efficiency and economy.

18

Write to CORTLAND GRINDING WHEELS CORP., 6 Cortland Street, Chester, Massachusetts

For Better Snagging

CORTLAND

(*Continued from page* 172)

probably advanced technical know-how in the industry by another fifty years.

James Bone, industrial bureau manager of the Los Angeles Chamber of Commerce, declared that Southern California was an important industrial section even before the war and urged his listeners not to put credence in threats that Los Angeles industry will fold up drastically when war contracts are removed. Mr. Bone defended his own optimism by asserting that it was based on facts and not upon Chamber of Commerce philosophy of the conventional sort.

Chapter president W. D. Bailey Jr. announced that the annual dinner-dance of the chapter is scheduled for April 14 at the Riviera Country Club.—*Maurice Beam.*

Western New York

REGULAR monthly meeting of the Western New York Chapter of the A.F.A., held March 2 at Hotel Touraine, Buffalo, had an attendance of approximately 135 members and guests. Chairman Reinhold D. Loesch presided. Myron L. Doelman, National Engineering Co., chapter member, was technical chairman and introduced his son, Robert L. Doelman, Harry W. Dietert Co., Detroit, who was speaker of the evening.

In presenting his subject, "Sand Affects Casting Finish," the speaker emphasized the importance of recognizing defects, analyzing their causes, and eliminating them. By the use of slides Mr. Doelman showed various types of defects traceable to sand mixtures. Scabs are caused by insufficient refractory bond, high moisture, a tightly rammed mold, uneven mold hardness, and high pouring temperatures, which can be overcome by altering sand mixtures, and spreading the grain distribution of the sand. Scabs, rat tails and buckles are related defects since all are caused by high expansion in sand mixture. Cereal binder may be added to decrease flowability, or the bond can be increased in synthetic sand and a percentage of a coarser or finer sand of a high clay content blended in to spread out distribution and increase strength in natural sand.

In wash defects poor gating is probably the most frequent cause but sand plays an important part. Low hot strength value coupled with a low hot deformation resulting in low hot toughness are weaknesses in sand mixtures which cause cutting or washing. Incorrect tempering, poor bonding materials or improper bonding materials and a low mold hardness are factors contributing to low hot strength and toughness. Mechanical metal penetration is caused by an early bond breakdown and can be traced to a core or mold sand that is too fine, has low hot strength, and in a core, too rapid collapsibility. Addition of cereals may help, but binders that are somewhat plastic at elevated temperatures will correct this problem.

The speaker then presented a film entitled "Mold Atmosphere Control," deal-

(*Continued on page* 178)

Pioneered by North American

LUMINOUS OR LONG FLAMES with either gas or oil are produced by the Series 113 Burners. They are desirable for vast coverage, for fewer burners and for uniformity of flame temperature.

SHORT FLAMES are produced by the Series 221 Burners. These burners provide a highly stable and efficient fire, using either gas or oil. They are recommended wherever heating in a relatively small space is required.

WRITE FOR DESCRIPTIVE LITERATURE

DUAL-FUEL BURNING SYSTEMS FOR GAS AND OIL

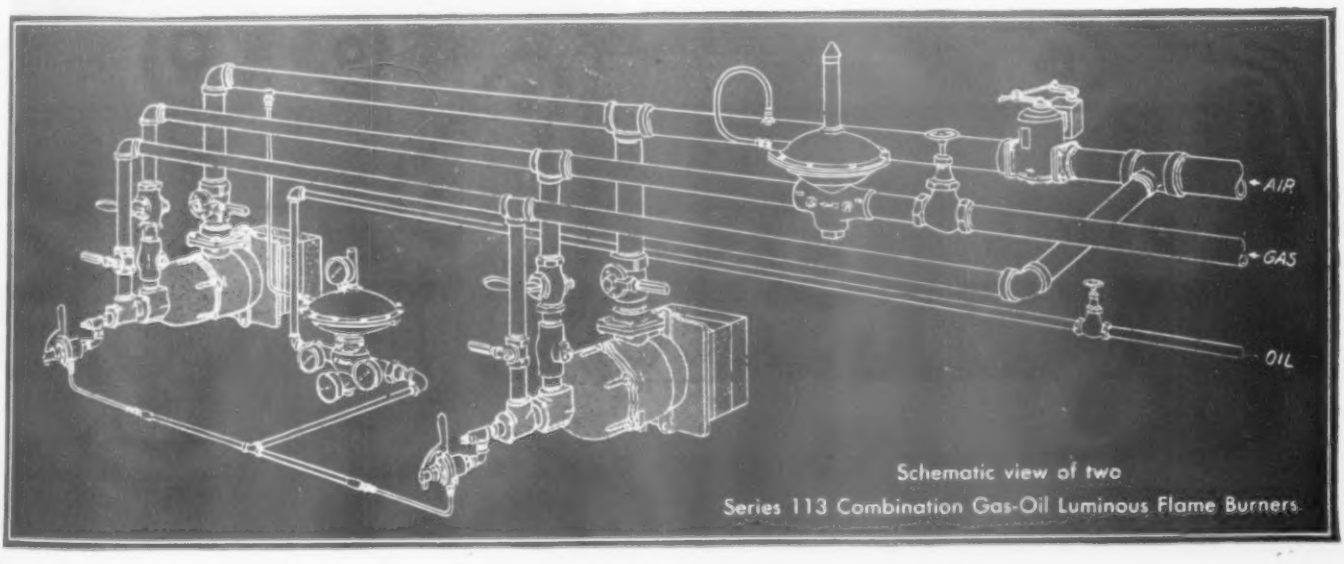
MAXIMUM EFFICIENCY WITH EITHER FUEL—designed especially for gas and for oil.

SWITCH FUELS INSTANTLY—no change required in piping or burner inserts.

AUTOMATIC FUEL-AIR PROPORTIONING—one air valve controls the fire of one or a battery of burners regardless of the fuel being burned.

WIDE TURNDOWN RANGE—no "flash back" possible.

THE NORTH AMERICAN MANUFACTURING COMPANY
MANUFACTURERS OF INDUSTRIAL FUEL BURNING EQUIPMENT FOR GAS OR OIL
BRANCH OFFICES with FIELD ENGINEERS in PRINCIPAL CITIES
CLEVELAND 4, OHIO



Schematic view of two
Series 113 Combination Gas-Oil Luminous Flame Burners

VELSICOL announces an improved CORESIN ...

What Is Coresin? CORESIN is the new synthetic oxidizing and polymerizing resin that has been developed by Velsicol especially for the manufacture of Velsicol Core Oils. It is now a basic ingredient of these products. The part synthetic resins play in imparting uniformity and other benefits to high quality paints and varnishes is well-known. Just so, CORESIN has introduced a new element of control into the manufacture of core oils that assures the UNIFORMITY of every gallon of Velsicol Core Oil. The active chemical principles in CORESIN also give measurable improvement to all the vital core oil characteristics, some of which are noted on the opposite page.

This means you can depend on Velsicol Core Oils without qualification to produce cores that bake faster, have higher tensile strength, less gas content, lower moisture absorption, better collapsibility and shake-out than conventional core oils; and they are suitable for both ferrous and non-ferrous metals. Thus Velsicol's resources in plant, laboratory, and chemical research have brought this new Core Oil to the highest pitch of performance.

For better castings and improved production, use Velsicol Core Oils in your foundry. Write us or the representative nearest you for samples and complete data.

VELSICOL

VELSICOL

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..

Core Oil based on its new development

with the following features:

Consistent
UNIFORMITY

Accelerated
BAKING TIME

Greater
TENSILE STRENGTH

More Rapid
COLLAPSIBILITY

All-Metals
ADAPTABILITY

CORP.

The Foundries Materials Company, Coldwater and Detroit, Michigan, and Hammond, Indiana; Midwest Foundry Supply Company, Edwardsville, Illinois; H. S. Stoller & Company, Akron, Ohio.

OL

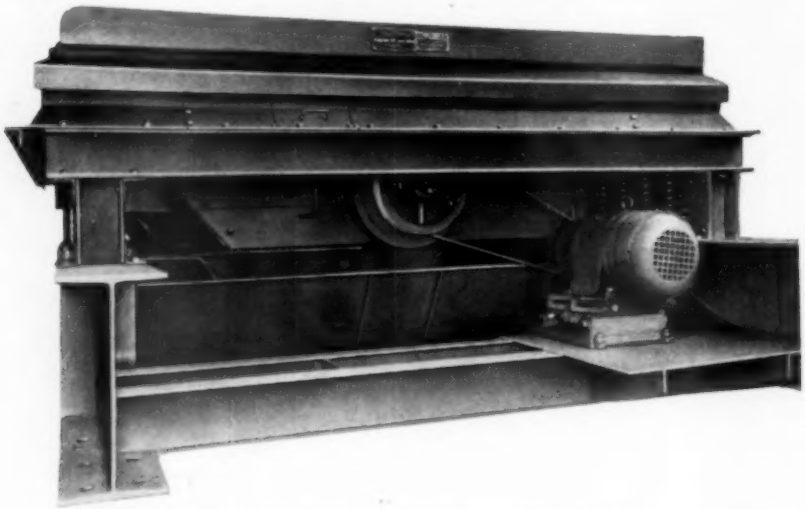
GENERAL OFFICES: 120 EAST PEARSON STREET, CHICAGO

Speaking of Shakeouts

WHAT ABOUT SAND-RECOVERY?

NO matter how you look at it, the installation of a Robins Floatex Shakeout is bound to save you time . . . and labor . . . and money. That fact is being proved every time another foundry buys one.

Just recently, a large eastern plant put a 4-unit 50-ton Floatex into service. Shortly after, the Plant Engineer told us, "I do not hesitate to say that this installation will pay for itself in a very short time. The saving on sand alone is a considerable item. Before we installed the Floatex, we lost a total of four carloads of sand a week, sent to the dump as waste. Now, all that sand is recovered."



You see, this Floatex was designed with sand hoppers leading directly to a sand conditioning system. In fact, we have gone even further than that in other cases—we worked out a method by which the sand is cooled, aerated and heaped as fast as it comes from the Floatex . . . eliminating all extra handling, lost time and wasted sand.

No matter how you look at it, the installation of a Robins Floatex Shakeout is bound to save you time . . . and labor . . . and money. We'll gladly prove it if you will invite a Robins representative to call. No cost; no obligation. Just write to Dept. F-4.

Robins Floatex Shakeouts are genuinely full-floating; they shake the flask—not the building. Made in Portable models for loaded flasks weighing up to 17 tons; in Standard models, up to 100 tons or more—non-discharging and self-discharging types.

ROBINS makes: BELT CONVEYORS • COAL AND ORE BRIDGES • BUCKET ELEVATORS • CAR AND BARGE HAULS • CAR DUMPERS • CAR RETARDERS • CASTINGS • CHUTES • CONVEYOR IDLERS AND PULLEYS • CRUSHERS • FEEDERS • FOUNDRY SHAKEOUTS • GATES • GEARS • GRAB BUCKETS • PIVOTED BUCKET CONVEYORS • VIBRATING SCREENS • SCREEN CLOTH • SELF-UNLOADING BOAT MECHANISMS • SKIP HOISTS • STORAGE AND RECLAIMING MACHINES AND SYSTEMS • TAKEUPS • LOADING AND UNLOADING TOWERS • TRIPPERS • WEIGH LARRIES • WINCHES • WINDLASSES

FOR MATERIAL AID IN MATERIALS HANDLING . . . . . It's ROBINS

ENGINEERS • MANUFACTURERS • ERECTORS

ROBINS CONVEYORS INCORPORATED
Founded in 1906 as Robins Conveying Belt Co.
PASSAIC • NEW JERSEY

MATERIALS HANDLING MACHINERY

(*Continued from page* 174)

ing with oxidation penetration. Laboratory tests made with the dilatometer were shown.

The object of the film was to show that by incorporating mold atmosphere control so that the gases in the mold are not oxidizing, much of the work in the cleaning room possibly may be eliminated. The speaker emphasized that the work was not complete nor conclusive, but presented to promote discussion on the subject. A lengthy discussion period followed showing of the film. —*J. Ralph Turner, secretary.*

Metropolitan

URGING foundries to "get busy on research as well as making castings," Harry W. Dietert, Harry W. Dietert Co., Detroit, focused the attention of the more than 120 present at the March 5 meeting of the Metropolitan Chapter of the A.F.A. on the subject of mold atmosphere control.

Illustrating his remarks with motion pictures and lantern slides, Mr. Dietert described the effect of various mold atmospheres on the surface finish of castings. He evaluated numerous types of facings and brought out reasons why certain materials give a smooth finish to castings. Particular emphasis was placed on metal penetration defects and their remedies. W. G. Reichert, W. G. Reichert Engineering Co., served as technical chairman.

Chairman T. D. Parker, Climax Molybdenum Co., New York, announced that at the next meeting, April 2, an exchange paper would be presented, dealing with production technique for high alloy castings, as prepared by F. H. Hoult, general manager, Kent Alloys Ltd., London, England, of the London branch of the British Foundrymen's Association.

At the same meeting A. Cristello, foundry manager, Eclipse Pioneer Division foundries, Bendix Aviation Co., Teterboro, N. J., will present a copy of his paper which has been sent to the London branch, as the Metropolitan Chapter's part in the exchange. Mr. Cristello's paper is on the subject of "Gating, Risering and Chilling of Magnesium Sand Castings." This exchange of papers between the two chapters has been going on for about 3 years.

In recognition of his services as chairman of the Metropolitan Chapter last year, J. W. Reid, R. Hoe & Co., Dunellen, N. J., was presented with a handsome fountain pen.

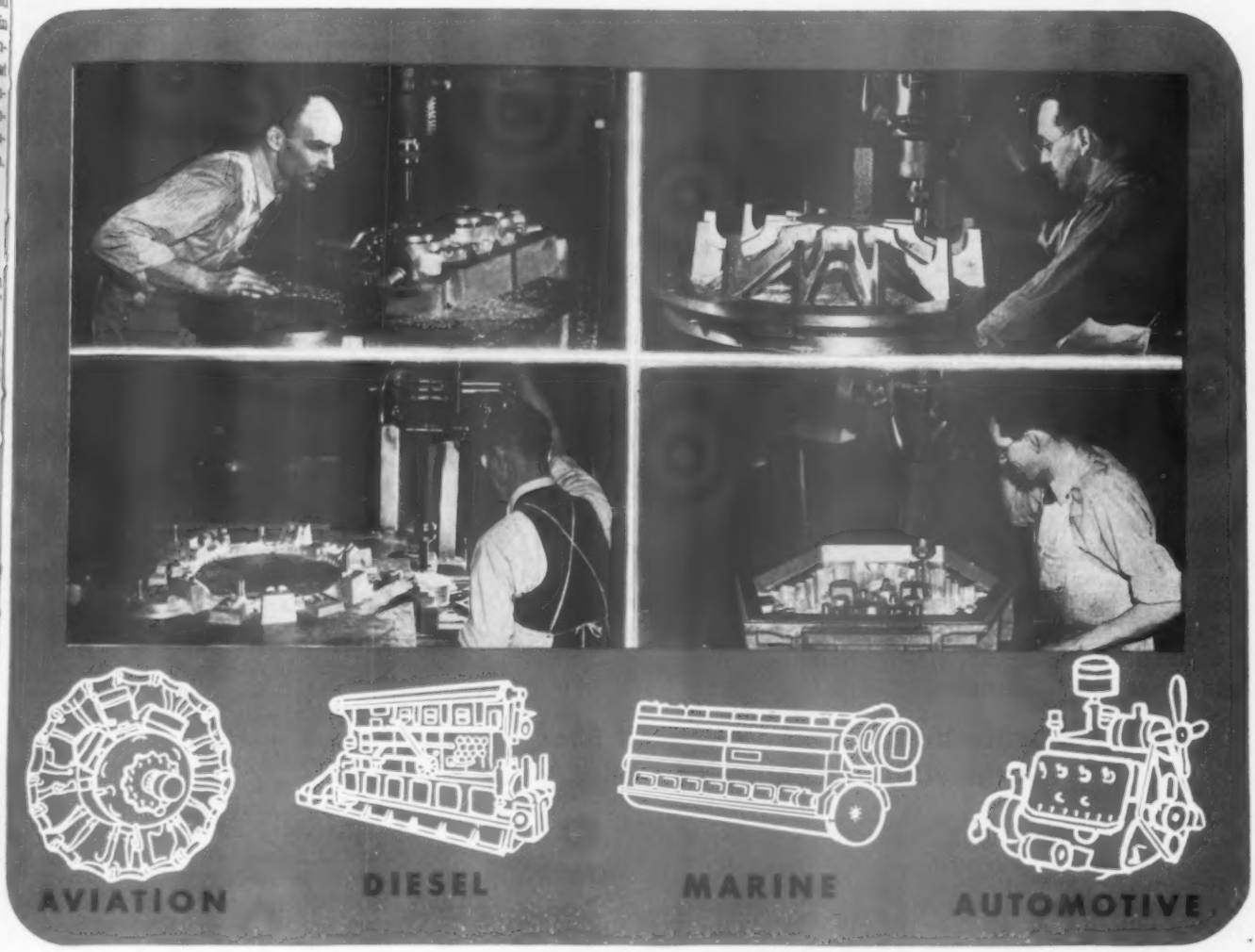
Reflecting lively interest in the work of the chapter, Ben Beldin, Whitehead Bros., New York, chairman of the membership committee, reported a substantial gain in number of new members in recent months.—*Ben K. Price.*

Saginaw Valley

SAGINAW Valley Group of the A.F.A. celebrated National Officer's Night at a dinner meeting held at Frankenmuth, Mich., March 1. The group was honored by the presence of Norman Hindle from

(*Continued on page* 180)

BUFFALO *Precision* PATTERNS

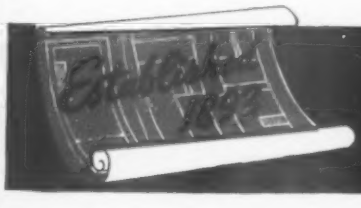


When Thousandths of an Inch Count...
Leading Manufacturers Count on **BUFFALO**

Accuracy is our business! At Buffalo Pattern Works we combine skill and know how in layout with a wide knowledge of metals, structural design and practical fabrication.

Thus, every Buffalo Pattern is a precision pattern—engineered to meet your stiffest requirements for split hair accuracy without sacrificing metallurgical soundness—designed to enable speedy, low cost production of the most intricate castings.

Many of America's leading automotive, aircraft and marine manufacturers rely on Buffalo Precision Patterns. Consult us now on your most difficult present or postwar pattern problem. Write or wire Dept. C.



BUFFALO PATTERN WORKS
830 Hertel Ave. Buffalo 16, N. Y.

"If I Ran a Foundry"

"I would build an honest-to-god washroom—make it a separate building, if necessary,—adjacent to the foundry.

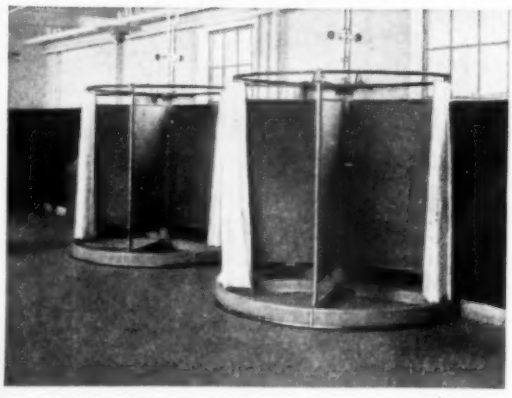
"My men would enter and leave through this room or building—leaving to go home refreshed and respectably clean.

"In this modern washroom—I would have sanitary group wash fixtures,—the latest in plant shower baths—lockers for clothing, etc. I consider such equipment as important as the foundry equipment itself. (Foundries are way behind general industry in providing such facilities.)

"I would be able to get the best men—and keep them. I would advertise my model wash building—to get men and to get foundry business."

Bradley Washfountains and Multi-Stall Showers Fill the Above Requirements

The Washfountains each serve from 8 to 10 persons simultaneously—each with clean *running* water from the central sprayhead. Deep, self-flushing bowls prevent collection of contaminating water, and permit washing thoroughly to the waist. Their use cut piping connections and water consumption by 70%, —and provide most facilities in least space.



A Multi-Stall Bradley Shower requires no more piping installation than one conventional "single-person" shower.

Workmen can wash to the waist in the clean, running water from the central sprayhead of a Bradley Washfountain.

Multi-Stall Showers apply the Bradley idea of group washing—and being shipped partially assembled can be installed readily. The 5-stall model requires one-fifth the piping and piping connections required for 5 "single person" bath stalls. BRADLEY WASHFOUNTAIN CO., 2217 W. Michigan Street, Milwaukee 1, Wisconsin.

BRADLEY washfountains AND multi-stall showers

Send for Catalog 4308 and Washroom Survey Sheet to help you make preliminary plans.

(*Continued from page* 178)

the executive office staff in Chicago, and Fred J. Walls, A.F.A. vice president.

Another guest was William G. Mixer, Buick Motor Division superintendent of foundries, who was introduced by Mr. Walls. Mr. Mixer is one of nine distinguished men who recently received an honor award presented by the Alumni Association of Stevens Institute of Technology of which Mr. Mixer is a 1909 graduate. Mr. Mixer's citation recognizes his excellent record in foundry engineering, and in particular the new Buick Aluminum foundry, which he designed.

J. A. Gitzen, Delta Oil Products Co., Milwaukee, gave an excellent lecture on "Physical and Chemical Properties of Core Binders, Core Washes and Their Reaction in Contact with Molten Metals." He approached his subject by describing the early types of core binders used in the foundry and pointing out the good and bad characteristics of each. Among those discussed were wood resins, petroleum pitch, and linseed oil. With these as a starting point he discussed why and how the modern blended core oil came into existence.

The speaker next dealt with the dry binders, such as the cereal type, red oxide and the clays.

In speaking of core complaints, it was stated that the majority of them could be traced back to insufficient baking of the core. In connection with core practices, Mr. Gitzen told the group of some interesting work on baking cores in a matter of minutes rather than hours by drawing air thru the core and speeding oxidation. A lively question and answer period completed the evening.

The next meeting is scheduled for April 5, when Anthony Cristello of the Eclipse Pioneer Division of Bendix Aviation will speak on the subject of "Aluminum and Magnesium Foundry Practice."
—*Joseph J. Clark, chapter reporter.*

Central Indiana

SEPARATE technical meetings by the ferrous and nonferrous groups were included in the program of the March 5 meeting in Indianapolis of the Central Indiana Chapter of the A. F. A. Approximately 100 members and guests attended.

Chapter Chairman Harold H. Lurie, who presided at the dinner gathering, announced appointment of the following committee to select nominees for officers and directors to be elected this spring: Chairman, Emil G. Schmidt Jr., International Harvester Co., Indianapolis; Richard H. Bancroft, Perfect Circle Co., New Castle; Robert Langsenkamp, Langsenkamp-Wheeler Brass Works Inc., Indianapolis; B. P. Mulcahy, Citizens Gas & Coke Utility, Indianapolis, and William Zigmueller, Electric Steel Castings Co., Indianapolis.

Guests at the meeting included Fred J. Walls, International Nickel Co., Detroit, and national A. F. A. vice president, and Norman F. Hindle, director,

(*Continued on page* 182)

Cleco Rammers

CARRY THEIR WEIGHT... JUST GUIDE 'EM TO THE WORK!

Want fast, easy-holding rammers for either floor, flask, bench or core work? You will find exactly the right model for your job in the complete Cleco line.

In addition to being great labor savers, Cleco Rammers improve casting quality by insuring uniform mold density. All models feature end pressure-seating valves that actually improve with use. The smaller models have effective poppet type throttles, while the floor models have snap throttles—both types are trouble-and-leak-proof. Large oil chambers insure efficient lubrication at all times. *Write for Bulletin 76B.*

Chippers, grinders, core breakers and air line accessories are also included in the Cleco line for the foundry.

SPECIFICATIONS

	No. 0B	No. 1	No. 4B	No. 1F	No. 4	No. 5
Length (including Butt)	17"	20½"	24"	43"	48"	49"
Weight (including Butt)	5¾ lbs.	12¼ lbs.	23½ lbs.	18 lbs.	22 lbs.	33¾ lbs.
Bore and Stroke	1" x 2"	1" x 4"	1¼" x 5"	1" x 4"	1¼" x 5"	1½" x 6"
Speed in Strokes per Minute	2500	950	950	950	950	750

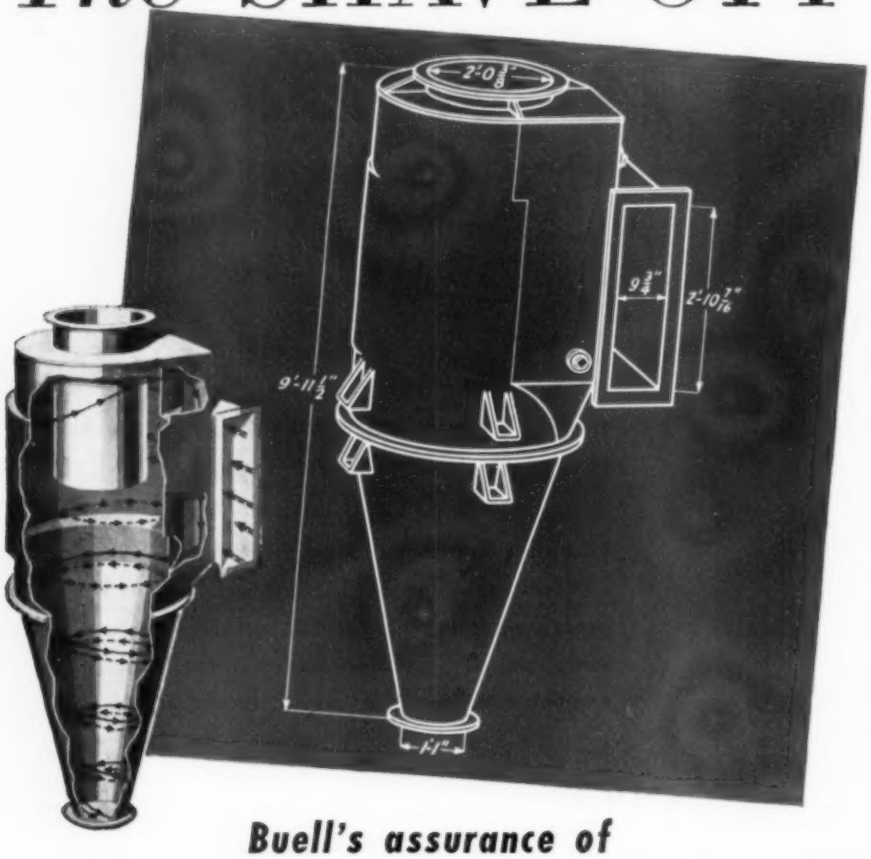
Help Finish the Fight! — Buy MORE War Bonds and Stamps!

THE CLEVELAND PNEUMATIC TOOL CO.

3784 EAST 77th STREET • CLEVELAND 5, OHIO

BRANCH OFFICES IN ALL PRINCIPAL CITIES

The SHAVE-OFF



Buell's assurance of
HIGH EFFICIENCY, LOW MAINTENANCE, LONG LIFE

SUCCESSFULLY utilizing the "double-eddy" current—an aero-dynamic phenomenon present in all cyclone-type collectors (established by van Tongeren)—Buell, and Buell *only*, effectively puts this force to work by an exclusive mechanical feature known as the "Shave-off". By means of this design feature, the important "fines" are collected and by-passed to the lower part of the cyclone where the downward flow of the "double-eddy" current automatically carries them to the dust discharge outlet.

In ordinary cyclones, this dust circulates under the top plate, finally dropping by gravity through the upward, rotating gas stream of the "double-eddy" current. Thus, in its passage to the dust discharge outlet, the "fines" become re-entrained in the gas flow and are partially lost through the gas outlet.

This exclusive feature of the patented Buell (van Tongeren) cyclone is a prime factor in Buell's well-known high recovery efficiency.

BUELL FEATURES

SHAVE-OFF
LARGE DIAMETERS
EXTRA-STURDY CONSTRUCTION
CORRECT HOPPER DESIGN
SPLIT-DUCT MANIFOLDS
INNER WELDS GROUND SMOOTH

RESULT IN

HIGH COLLECTION EFFICIENCY
LESS FAN BLADE WEAR
LOW DRAFT LOSS
LOW POWER CONSUMPTION
HIGH TEMPERATURE RESISTANCE
UNLIMITED CAPACITY
NO MOVING PARTS
FREE DUST FLOW

PRODUCE

HIGH EFFICIENCY
LOW MAINTENANCE
LOW OPERATING COST
LONG LIFE
NO CLOGGING

buell
DUST RECOVERY SYSTEMS

Convincing facts about the "Shave-off" may be found in Buell's bulletin—*"The van Tongeren System of Industrial Dust Recovery"*

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Sales Representatives in Principal Cities

DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

(*Continued from page* 180)

A. F. A. technical development program. Mr. Walls in a brief talk urged the foundry industry to give greater thought to the sources of its future personnel supply, and to take the steps necessary to make the industry more attractive to young men. Mr. Hindle reviewed some of the recent actions by the national organization.

"Porosity in Steel and Cast Iron" was the subject discussed before the ferrous group by Carl Zapffe, assistant technical director, Rustless Iron & Steel Corp., Baltimore. Fred Kertz, Electric Steel Castings Co., served as technical chairman. Mr. Zapffe used numerous slides to illustrate how sponginess in castings results from the introduction of gases—usually hydrogen—into the molten metal, and described the conditions which permit the pickup of hydrogen and its eventual release to cause pinhole porosity.

M. E. Brooks, foundry metallurgist, Dow Chemical Co., Bay City, Mich., addressed the nonferrous group, with Fred Carl, Delco-Remy Division, General Motors Corp., Anderson, Ind., acting as technical chairman. Discussing "Magnesium Casting Methods," Mr. Brooks described modern magnesium foundry practices, including heat treatment.—*William G. Gude.*

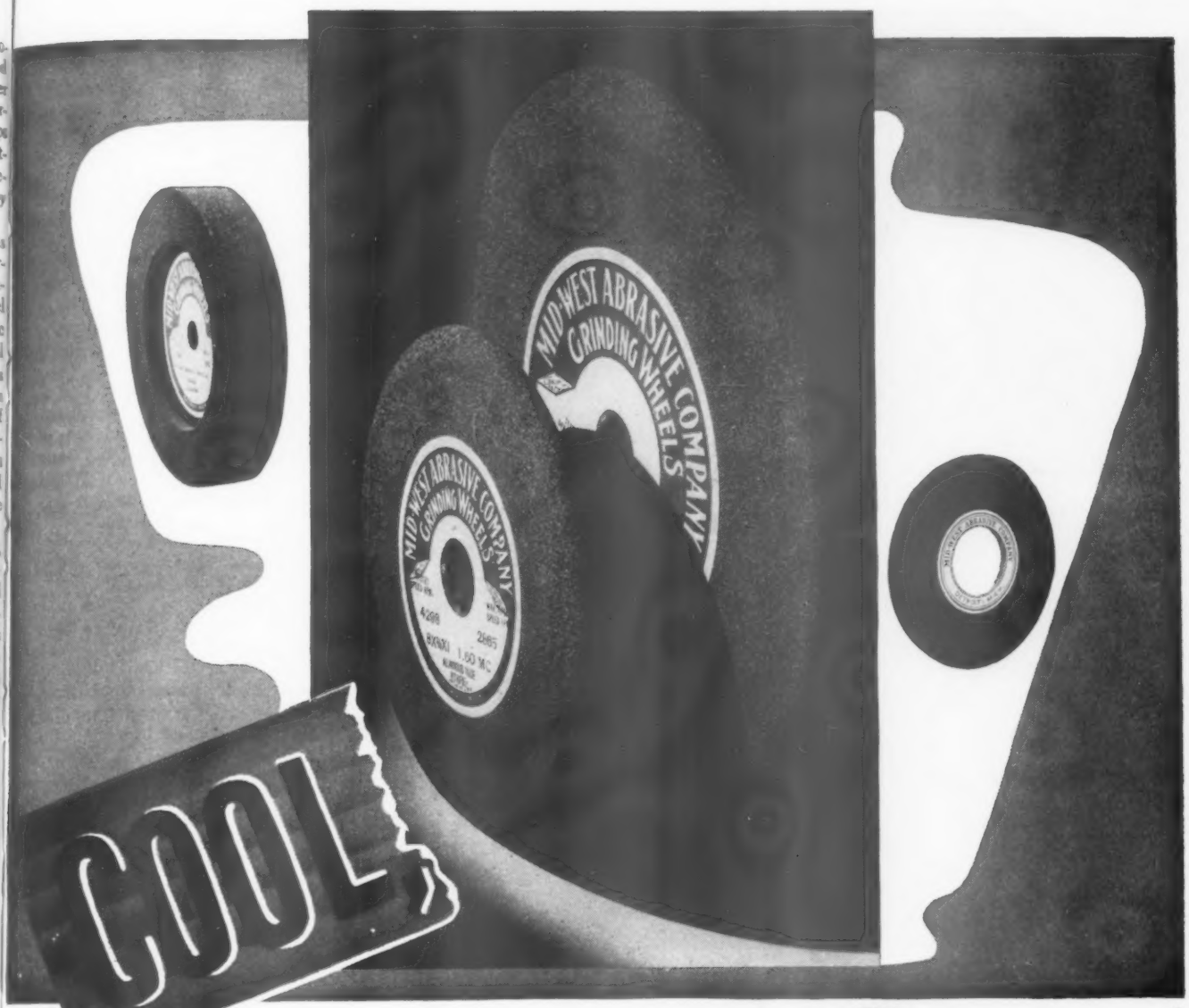
New Jersey

ASSERTING that a sound incentive system is one of the most productive tools of good management, George H. Elliott, vice president, Norris & Elliott Inc., management engineer, New York, discussed incentive plans before members of the New Jersey Foundrymen's Association at Newark Athletic Club, Newark, Feb. 26. A properly installed and operated incentive plan, he said, increases production and wages and lowers cost, and has the encouragement of WPB and WLB.

Also a feature was the discussion of a pending program for revising New Jersey's workmen's compensation law by T. Hickey and George Meredith of the Manufacturers Association of New Jersey, who were introduced by Gerald Hannay, Barnett Foundry & Machine Co., Irvington, N. J., and chairman of the New Jersey Foundrymen's Association's legislative committee.

With J. M. Hogan, Bierman-Everett Foundry Co., Irvington, presiding as president, Mr. Elliott pointed out that proper incentive programs conflicted in no way with the wage stabilization laws. In installing such a system forms have to be made out for the approval of Washington and it must have the support of both management and labor. He suggested that studies be made over a period of at least four to six weeks, or until the engineer in charge of the study can get "the feel of the work," before an application is filed. He emphasized the importance of having the study made by someone thoroughly familiar with incentive and time study work.

(*Continued on page* 184)



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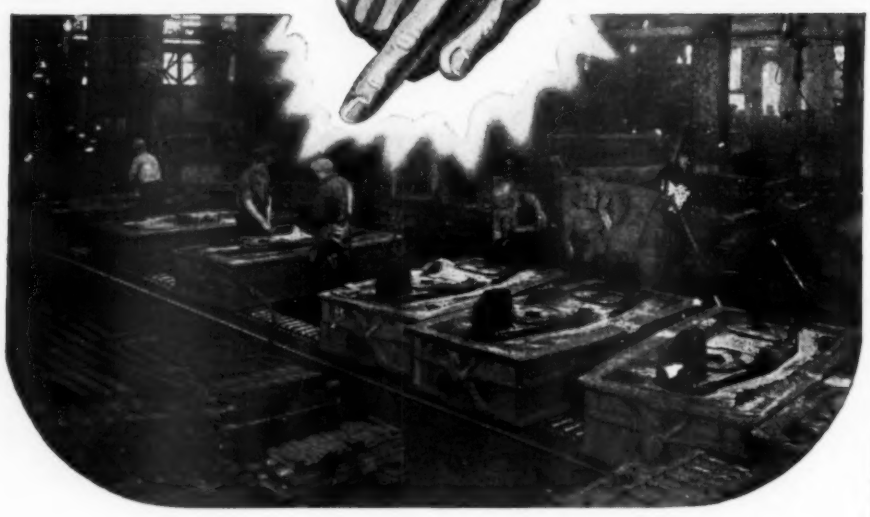

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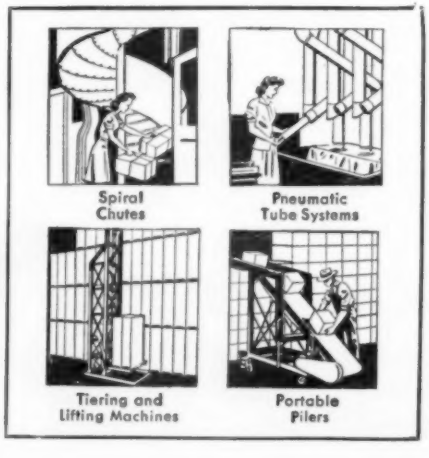


(*Continued from page* 182)

He said that there are really three features to an incentive program: (1) Measurement, done on a time basis; (2) stimulation of labor effort, through opportunity to increase earnings; and (3) control of costs, labor effort, materials, etc. Any incentive plan, he added, must make full allowance for fatigue and effort; and whenever production methods are changed, incentive standards should be promptly checked and if necessary, revised. He opposed the establishment of temporary standards.

For jobbing foundries, problems in installing an incentive program are more complicated, but, he emphasized, can be worked out so that production and wages are increased and costs reduced. He discussed various points raised in connection with jobber operations, and estimated that it would take six months or more to set up an effective incentive system in such a plant.—*Ben K. Price*

Twin City

FEB. 20 meeting of the Twin City Chapter of the A.F.A., held at the Curtis Hotel, Minneapolis, had as its speaker Frank Kiper, assistant to the plant superintendent, Ohio Steel Foundry Co., Springfield, who talked on "Cast Steel Breech Rings." He was assisted by Paul Eubanks, heat treat foreman, Springfield plant, and Arthur F. Gross, metallurgist, Walter Lynn, heat treat foreman, and H. R. McCoy, chief metallurgist, of the Lima plant. Mr. Kiper is secretary of the Central Ohio Chapter of the A.F.A.

Bob Wood, Electric Steel Castings Co., Minneapolis, and vice president of the Twin City Chapter, presided at the meeting and introduced the men from Ohio Steel Foundry, as well as Howard Patton, formerly of that company and now foundry superintendent, American Hoist & Derrick Co., St. Paul.

Mr. Kiper explained that earlier in the war there was an urgent need for guns for our own use and for lend-lease. The Ordnance Department selected castings for the breech rings because they could be supplied faster and cheaper than forgings. Although castings have proved their value many times in a variety of applications, early reaction to the cast breech ring was illustrated by a lend-lease customer who protested their use. He was even more surprised to learn that the barrel had also been cast.

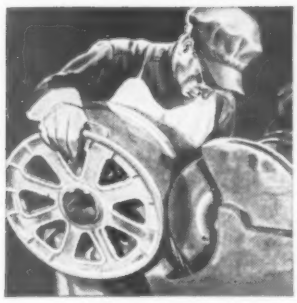
The castings, supplied for a wide variety of Army and Navy guns, were broached from an as-cast surface held to a bilateral tolerance of 1/32-inch. Rough machining was eliminated and the time required was 30 per cent or less of the time required for machining a forging.

Close tolerances on size, absolute soundness, and narrow ranges for mechanical properties required perfect co-operation and understanding by everyone in the shop. Special working drawings were prepared showing only the essential details. Wooden models of the breech rings were a great aid in discussing, planning, and

(*Concluded on page* 186)

Just as magnesium casting alloys lighten products . . .

so Dow's unmatched technical experience can lighten production costs



When Dowmetal magnesium alloys enter your shop, they bring with them the results of 29 years' experience by the pioneer producer of structural magnesium: complete dependability in supply . . . a full line of fluxes and accessory materials . . . the technical services of an expert staff of metallurgical specialists.

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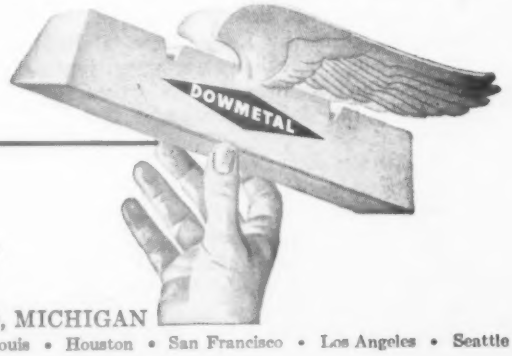

MAGNESIUM DIVISION, THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

(*Concluded from page* 184)

instructing, according to Mr. Kiper. He stressed the necessity of having good patterns, streamlined for directional solidification. Surfaces to be broached were cast vertical wherever possible to make them self-cleaning. All patterns were gated, the sand was rammed by slinger to a hardness of 80 to 85, and no patching was allowed. Molds were skin dried in ovens, after a silica wash. The cores were blown baked in driers, and assembled, and set in the molds by means of gages.

Mr. Kiper told how critical alloys were saved by using a manganese-molybdenum alloy instead of the customary nickel-chrome composition. He stated that breech rings were poured from acid and basic open hearth furnace and heat treated together, but no significant difference in properties was evident. This gives emphasis to the fact that good steel is good steel, regardless of the melting unit. The castings were water quenched and tempered to fall within a yield point range of 65,000 to 80,000 psi. Reduction in area was usually as high as 60 per cent, although 40 per cent minimum was specified.

The castings were subject to constant examination. Test bars cast with the castings were regularly used and supplemented periodically by bars cut directly from the casting. Sectioned castings were given macro and micro examination and grain size measurements. Internal inspection was by means of x-rays and radium, and the castings were also magnafluxed. In one test, a steel wedge was forced into various breech block openings by dropping a 3900-pound weight; deformation without cracking occurred.

After the talk, which was well illustrated by numerous slides, there was a long discussion. A description of the "exothermic lozenges" used in risers was particularly revealing. Coal crushed to 12-mesh was bonded into discs about 3 inches in diameter and ½-inch thick, which were used to keep the risers fluid. The practice was so valuable that the absence of the characteristic depression in a riser was cause for holding the casting until extensive tests proved its soundness. For blind risers a sea-coal cone was used and made an integral part of the mold.—*Herbert F. Scobie, program chairman.*

Ontario

CORES, Core Binders and Core Washes" was the subject of an interesting address by J. A. Gitzen, Delta Oil Products Co., Milwaukee, at the Jan. 26 meeting of the Ontario Chapter, A.F.A. at the Royal Connaught Hotel, Hamilton.

Mr. Gitzen discussed various types of core binders under two principal classifications: Organic binders which are destroyed by temperatures up to 1000 degrees Fahr.; and inorganic binders which develop their properties at high temperatures. The speaker also discussed washes and facings, defining a wash as an inert seal for a core to prevent leakage of gas.

The national board of the A.F.A. was represented at the meeting by Directors Ralph T. Rycroft of Buffalo and Joseph Sully of Toronto. Mr. Rycroft spoke briefly on the association's technical development program, and Mr. Sully referred particularly to the value of sustaining membership in helping to support this activity.—*G. L. White, publicity chairman.*

OBITUARY

CARL M. BEATTIE, general manager, Lake City Malleable Co., Cleveland, died Feb. 28 at his home in that city. Mr. Beattie went with Lake City Malleable in 1936, previously having been president of Jewell Alloy & Malleable Co., Buffalo, for 8 years. He was born in Salem, N. Y. Mr. Beattie was a member of the Northeastern Ohio Chapter, A.F.A.

CARL M. BEATTIE

° ° °

Byron H. Newell, 54, assistant manufacturing manager of Buick Motor Division, died March 12 at Flint, Mich. Born in Columbus, O., and educated in schools there, he was graduated from Ohio State University. Mr. Newell started as an apprentice and molder at the Ohio Malleable Iron Co., in 1907, he worked in many factories prior to his military service in 1918. Discharged from the army he went to Michigan in 1919 as Ford foundry contract representative. Later he was with Dodge, Oakland and Cadillac, going to Buick as foundry superintendent in 1934. When Buick intensified its war production in early 1941 he was promoted to assistant general superintendent. In December of that year he was advanced to general superintendent, and in 1942 he was appointed assistant manufacturing manager.

° ° °

Albert S. Bonner, 53, president, Clark Equipment Co., Buchanan, Mich., died there Feb. 8. A native of Staten Island, N. Y., he was graduated from Princeton University in 1913 and joined Clark Equipment Co. in 1915. Mr. Bonner became secretary-treasurer in 1924, executive vice president in 1938, and was elected president in 1942, succeeding the late Eugene B. Clark.

° ° °

Heber H. Stephenson, founder of Lawrence Clay Co., Jackson, O., died Feb. 6 in that city. Mr. Stephenson was president and treasurer of the company until shortly before his death. His brother, B. S. Stephenson, is president of Tonawanda Iron Corp., North Tonawanda, N. Y.

° ° °

Mrs. W. Scott Thomas, wife of the late W. Scott Thomas, died recently at St. Thomas, Ont. Mr. and Mrs. Thomas conducted a foundry supply business in Providence, R. I., which Mrs. Thomas carried on following Mr. Thomas' death in 1938.

° ° °

Horatio G. Shumway, 79, president C. W. Shumway & Sons, Batavia, Ill., gray iron foundry, died Feb. 15 in Geneva, Ill. He was a past president of the Chicago Foundrymen's Association.

° ° °

Lyle H. Dayhoff, 59, founder and chairman, Republic Coal & Coke Co., Chicago, and president, Mariah Hill Super Block Coal Co., Mariah Hill, Ind., died Feb. 16 in Miami Beach, Fla.

° ° °

Benjamin Nields, assistant vice president, National Malleable & Steel Castings Co., Cleveland, died Feb. 26 in that city. Mr. Nields had been in charge of the company's department of railway sales.

° ° °

Ralph J. Edmiston, 63, salesman for the United States Graphite Co., Saginaw, Mich. for 27 years, died Jan. 28, in Pittsburgh.

° ° °

Sidney D. Waldon, 73, treasurer, General Machinery Co., Hamilton, O., and former vice president, Packard Motor Car Co., Detroit, died Jan. 20, in Hamilton.

° ° °

George Haehnle, secretary and treasurer, the L. Schreiber & Sons Co., Cincinnati, died recently in that city. Mr. Haehnle had been associated with the company for 58 years.

° ° °

Huntington Downer, 57, manager of sales, Basic Refractories Inc., Cleveland, died Feb. 11 in Ft. Lauderdale, Fla.

° ° °

Andrew C. Perkins, president of the Georgia Iron Works, Augusta, Ga., died Jan. 7.

° ° °

Paul C. Meyer, 52, personnel manager, Universal Foundry Co., Oshkosh, Wis., died Feb. 16 in that city.

° ° °

J. Scott Parrish, 75, president, Richmond Foundry & Mfg. Co., Richmond, Va., died there recently.

RIGHT... down the line in types and sizes

You'll find all types and sizes of Bay State Grinding Wheels for all types of work ... RIGHT, down the line. Centerless grinding, cylindrical grinding, disc grinding, internal grinding, snagging, cutting-off, etc. . . . Sizes, shapes, bonds, grades, grains, and structures to meet specific requirements right.

And once you have determined on a type and size that suit your job right, you can expect to get the very same qualities on repeat orders. "Top performance, consistently duplicated" results from extremely close control over materials and manufacturing processes plus such Bay State features as

"Fractional Grades"— 3 degrees of hardness within every grade; developed to permit a closer fit of grit to grind.

"Controlled Porosity" — a precise method of spacing cutting units which not only makes closer selection possible but also exact duplication.

Such a combination of features are your assurance of getting grinding wheels that are RIGHT — down the line. So whatever your needs for grinding wheels, look into the advantages offered by Bay State's complete line. Write for bulletin to get additional facts.

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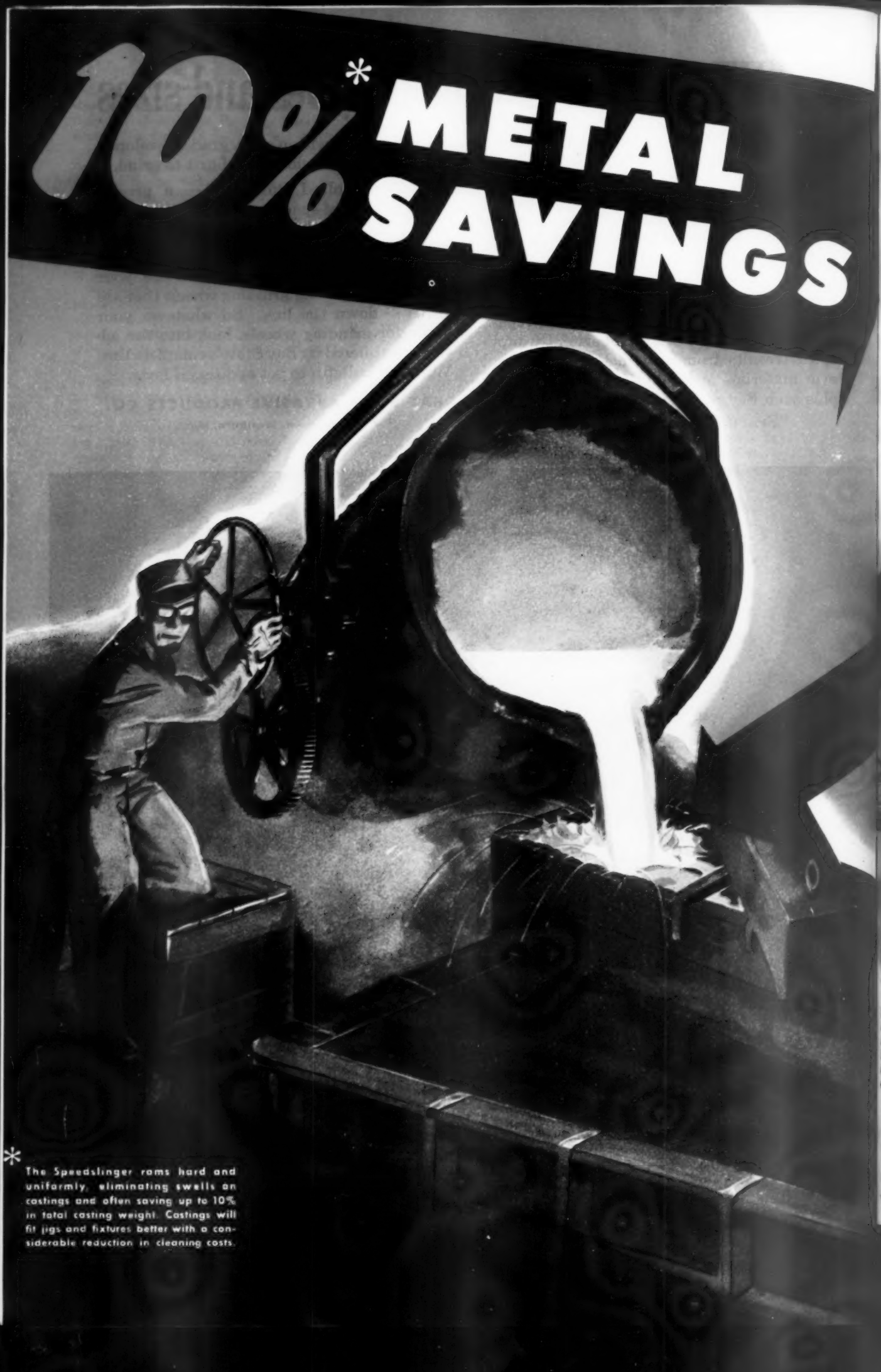

* The Speedslinger rams hard and uniformly, eliminating swells on castings and often saving up to 10% in total casting weight. Castings will fit jigs and fixtures better with a considerable reduction in cleaning costs.

WITH SPEEDSLINGER RAMMED MOLDS!

For medium and large jobbing work, the Speedslinger will deliver and ram one ton of sand per minute or 60 tons per hour at an average cost of .003 cents per cu. ft., as compared to .08 per cu. ft. for hand filling and air ramming, or a ratio of 27 to 1 in favor of the Speedslinger!

Speedslinger operator sits in this seat directing every function of the machine through centralized finger-tip control. Men or women—even those inexperienced in operating machinery—can easily and accurately control the Speedslinger.

Metal saving is just *one* advantage of the Speedslinger. Its hard, uniform ramming helps to improve casting quality . . . its ramming capacity of up to a ton of sand per minute speeds production and increases the productive capacity of the floor space it occupies. It will ram all types of molds, small, medium and large, and has the flexibility to operate over pits, molds and large cores. It makes an amazing contribution in man-savings—having the capacity to do the ramming for 50 molders per 8 hour shift!

The Speedslinger requires no elaborate or expensive sand handling system. It carries its own sand to the job in the kind and quantity needed. Traveling on a track under its own power, it can easily reach all types of molds within a ramming radius of up to 25 feet.

Inquire now about the Speedslinger. Write for booklet giving engineering data and specifications—or ask to have a B & P Sales Engineer call to recommend the proper method of installation in your foundry. Write today!

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THE BEARDSLEY & PIPER COMPANY ARE MANUFACTURERS OF SPEEDSLINGERS, SPEEDMULLORS, SANDSLINGERS, SCREENARATORS, MULBAROS, SHAKE-OUTS, SAND CONDITIONING MACHINES, GYRATORY SCREENS

"SHOW ME"...
THE AMAZING MULBARO!

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Mulbaro is comprised of two sections . . . top section contains mulling mechanism which lowers down onto mulling barrow containing sand to be mulled. Portable . . . versatile . . . low-cost, efficient mulling . . . *that's* the Mulbaro!

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INJURIES AND ACCIDENT CAUSES

(*Continued from page* 104)

average rate of 53.1 for the melting departments of the non-job foundries was higher than that for any of the other departments except the shakeout departments. Among the melting departments of the ferrous job foundries, those which operated electric furnaces had the highest average frequency rates (77.9) and those which operated open-hearth furnaces had the lowest (51.8). Among the melting departments of the non-job foundries, on the other hand, those operating cupola furnaces had the highest average rate (61.7) and those operating crucible furnaces had the lowest (34.4).

Injuries to feet and toes, hands and fingers, eyes, and backs were most common among the melting department injuries reported in the survey. Protection from hot and heavy materials is recognized as essential in this department, but the injury distribution indicates that the proper protective equipment frequently is not used. It is evident that greater attention should be given to the use of protective equipment for the lower extremities, and that the use of gloves and goggles should be stressed.

Cleaning, Chipping and Finishing — When castings are first removed from the mold they are generally somewhat rough and have armlike spurs resulting from molten metal filling the gates and risers. These superfluous projections are removed with a sledge, a metal bandsaw, or a power operated shear. The castings are then either tumbled or sand blasted. Small castings may be sand blasted inside a closed machine but large castings must be cleaned in the open or in a large enclosed blasting room. Great quantities of flying particles and dust accompany all sand blasting and present serious hazards to all workers in the vicinity unless proper precautions are taken. Gloves and goggles are essential equipment for the operator of a blasting machine, and blasting room workers should wear fresh-air-supplied airline helmets or masks, gloves, and heavy clothing. The blasting room should have an efficient exhaust system discharging into a dust arrester in order to provide visibility and to prevent the dust from escaping into the plant.

After the castings have been tumbled or sandblasted any remaining undesirable projections are removed either by chipping or by burning with an oxy-acetylene torch. Chipping is generally performed with a pneumatic chisel although a hand hammer and chisel are used at times. Goggles, gloves, and heavy garments are essential for the protection of the chippers and for all others who come near the chippers.

In the burning process the operator

(*Continued on page* 192)

YOU CAN

CLEAN CASTINGS

BEFORE YOU CAST THEM

Use a Product for your moulds and cores that has been made expressly for that purpose!

McCORMICK
VULCAN BLACKING
FOUNDRY FACINGS
LION BINDER
EASY CLEANER CORE COMPOUND
SUPERIOR PLUMBAGO
SILKOTE

VULCAN BLACKING is the material to use on dry sand molds and cores to have the sand actually fall away from the castings during shaking out.

SUPERIOR PLUMBAGO is the material to use on green sand molds.

EASY CLEANER CORE COMPOUND makes a core that cleans out with the minimum of labor.

LION BINDER should be used for pasting cores - - and in oil sand cores to speed up production and reduce core making costs.

SILKOTE is the mould and Core Wash for steel foundry sands. Mix with plain water only.

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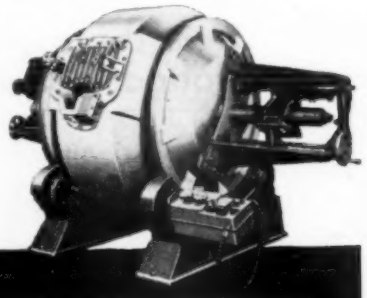
Melts Ni-Hard **AND ANY OTHER FERROUS OR NON-FERROUS METALS QUICKLY AND EASILY**

Quickly heated to 2950° F. under precise metallurgical control, a quarter-ton of Ni-Hard cast iron is shown in the picture above being tapped into a ladle from a Detroit Rocking Electric Furnace. Because of the Detroit automatic stirring action under non-oxidizing conditions and because the Detroit Furnace design permits close control of time, temperature, and other melting factors, higher quality ferrous or non-ferrous castings are assured. Melting takes place in a closed chamber, thus reducing dirt and fumes to a minimum.

Versatile, flexible and fast, Detroit Rocking Electric Furnaces have proved their worth in scores of foundries. They insure faster melting—as many as eight ferrous or sixteen non-ferrous heats in one 8-hour day. And they assure more production per man hour with lower metal losses and less machine shop scrap. Detroit Rocking Electric Furnaces, available in sizes from 10 lbs. to 4 tons, are a sound investment in quality casting production in your foundry. Write for complete facts.



DETROIT ELECTRIC FURNACE DIVISION
KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

(*Continued from page* 190)

must wear filter lens goggles as protection against the glare of the torch flame and the molten metal, while heavy gloves and heavy clothing are essential for protection against burns from the hot metal and sparks.

The final, or finishing, process in cleaning castings is to grind off the remaining rough spots and chisel marks, left by the chipper, by the use of an abrasive wheel. Grinding produces large quantities of flying emery and metal particles which constitute a very great eye hazard, not only for the operator but also for everyone else in the vicinity of the operation. Goggles are essential equipment in this operation, even when there is an exhaust attached to the grinding wheel. Grinding wheels also present a number of other hazards. If they are improperly mounted, operated at excessive speed, struck a sharp blow while in motion, or used for a type of work other than that for which they were designed they may shatter and the pieces may fly in any direction. It is important, therefore, that grinding wheels be mounted properly and used only in accordance with the manufacturer's instructions, and that each wheel be covered with a guard which will effectively check any flying pieces if the wheel should break. Grinders are also exposed to the danger of severe cuts or abrasions if they should come into contact with the moving wheel.

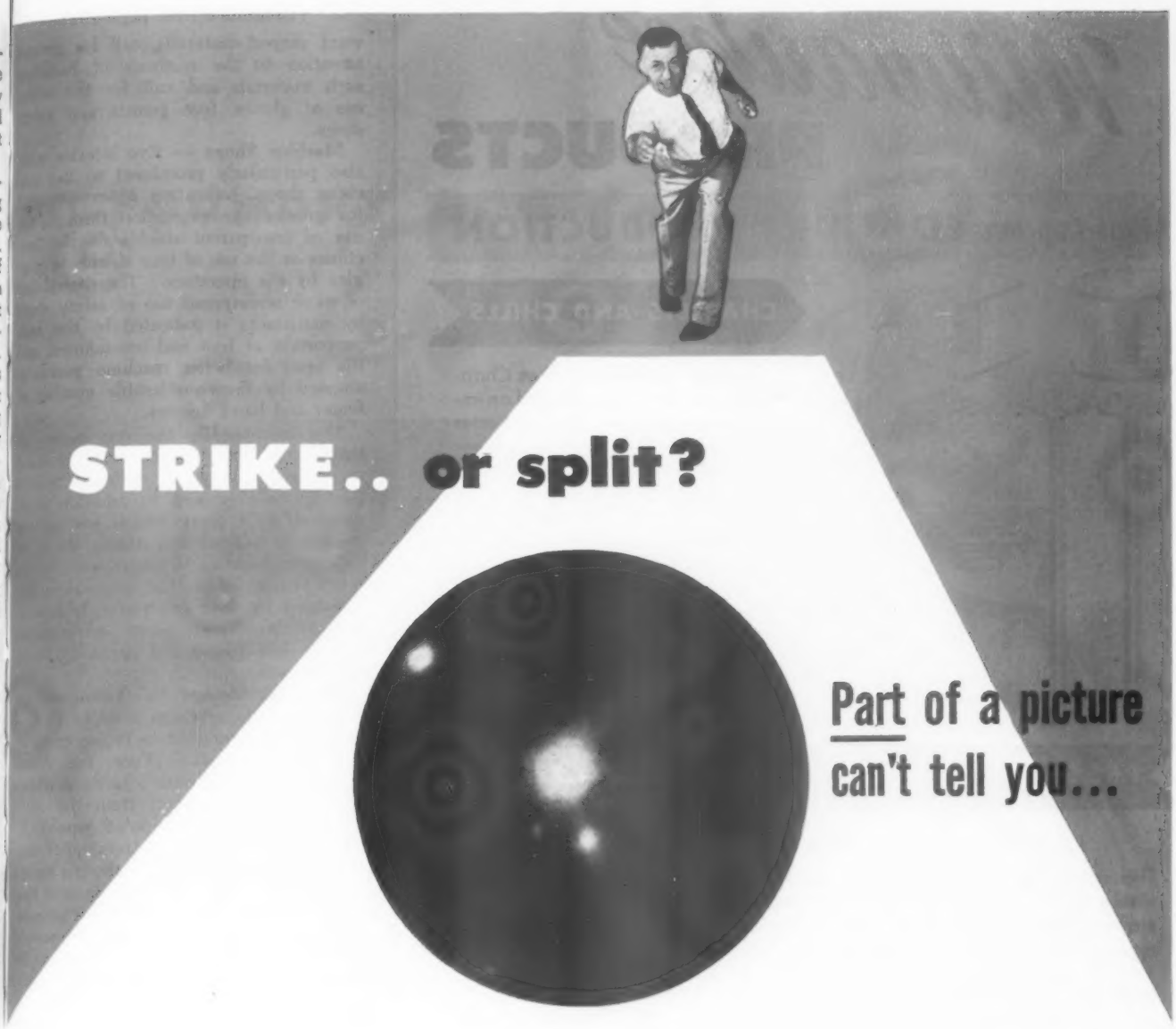
Danger Always Present

In all cleaning, chipping, and finishing operations the workers are constantly exposed to the possibility of injury arising from the necessary handling of the castings. The castings, which are frequently quite heavy, must be moved and turned so that all surfaces can be reached. This presents possibilities of strained backs, and of bruised or mashed fingers and toes. Rough spots and sharp edges on the castings also present the possibility of severe cuts and scratches to the workers who handle them. The use of gloves and safety shoes by all workers in this department is generally recognized as desirable.

In the ferrous job foundry group the cleaning, chipping and finishing departments had the highest average injury frequency rate (73.1) among the major operating departments. In the nonferrous foundry group and in the non-job foundries, however, the frequency rates of the cleaning, chipping, and finishing departments were somewhat lower than the corresponding rates of the melting departments. The cleaning, chipping, and finishing rates of 46.1 in the nonferrous group and 50.2 in the non-job foundries were, nevertheless, quite high.

Eye injuries were of outstanding importance in the cleaning, chipping and finishing departments and by their numbers indicate strongly the great need for the universal use of goggles by all workers in these departments. The high proportions of finger, hand, foot, toe and back injuries, all of which are related to the handling of heavy, rough, and awk-

(*Continued on page* 194)



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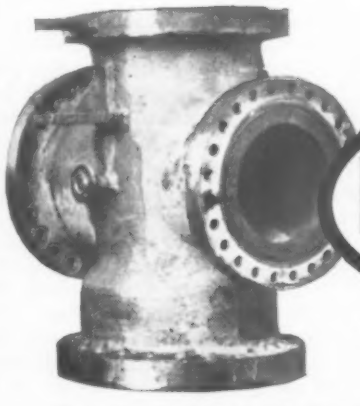

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2. CONCENTRATED FORM—high sand to oil ratio; economical.

3. NO OBNOXIOUS ODOR—during mixing, baking or pouring.

4. NO SEEPAGE—will not settle or drain to the bottom of sand mix or green, unbaked cores; baked cores will not stick to plate.

5. NO CRUSTING OF GREEN MIX—air dries slowly; green mix can be stored as long as 24 hours and still be usable.

6. CLEAN WORKING—eliminates frequent cleaning of core boxes; sharp draws.

7. WIDE TEMPERATURE BAKING RANGE—small and large cores can be baked at the same time; no burnt cores.

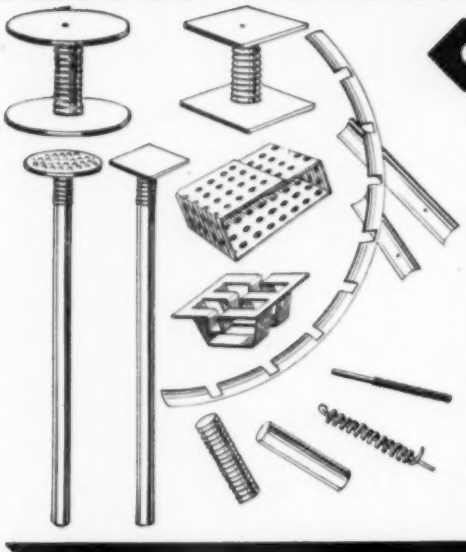
8. POLYMERIZED FORMULATION—maximum strength right through to center of baked core; dryer and plate side of equal hardness as exposed surfaces; no adherence.

9. MINIMUM GAS—less venting; fewer blows; lower casting losses.

10. AMPLE COLLAPSIBILITY—no hardened lumps to dig out; disintegrates while allowing metal to solidify and cool; fewer cracked castings.

Milwaukee PRODUCTS

that Improve FOUNDRY PRODUCTION



CHAPLETS AND CHILLS

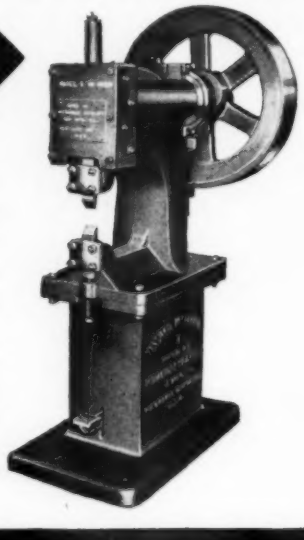
For many years Milwaukee Chaplets and Chills have played an important part in producing better castings in less time, with fewer rejects. Their design and quality is being improved constantly to help the foundryman meet the demand for finer workmanship and higher production. Ask for samples and prices of Milwaukee Thread Stem Chaplets—Standard Radius Chills—Schmitz Chaplets — Patented Adjustable Radius Chills — Shells, Tubes and other types of Chaplets and Supplies.

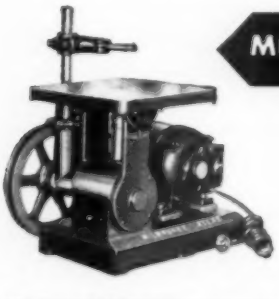
TESSMER SPRUE CUTTER

For Non-Ferrous Foundries

This simple, sturdy machine removes sprues with a single stroke. It replaces slow, tedious manual labor, with a swift, clean, effortless machine operation . . . releasing vital manpower for more important tasks. Low operating costs are assured through these advantages:

1 — Tool-Steel Cutting Knives cannot fill with Soft Metal. 2 — No auxiliary exhaust system to carry off metal particles and dust. 3 — Maintenance is limited to the occasional sharpening or rare replacement of alloy steel cutting knives. 4 — Moving parts properly lubricated, and shielded from dust and dirt. 5 — Wearing parts made of durable materials; are easily adjusted or replaced, if necessary. *Write for literature.*





MILWAUKEE ATLAS FILING MACHINE

A well designed, bench type machine of rugged construction for rapid and accurate trimming of intricate castings, and filing dies, jigs or fixtures. Eliminates many slow, costly hand filing operations.

$125.00 Complete with Motor.

Milwaukee

CHAPLET AND MANUFACTURING CO.

1025 S. 40th STREET • MILWAUKEE 4, WIS.

A 4661-

(*Continued from page* 192)

ward shaped materials, call for greater attention to the methods of handling such materials and call for the wider use of gloves, foot guards and safety shoes.

Machine Shops — Eye injuries were also particularly prominent in the machine shops, indicating a serious need for greater eye protection through the use of transparent shields on the machines or the use of face shields or goggles by the operators. The desirability of more widespread use of safety shoes by machinists is indicated by the high proportion of foot and toe injuries, and the need for better machine guards is stressed by the considerable number of finger and hand injuries.

Maintenance—By the very nature of their work maintenance workers meet on occasion every hazard faced by any foundry worker and in addition must contend with many which are seldom present in normal operations. As a result, maintenance workers sustain all types of injuries and the outstanding fact indicated by their experience is that as a very minimum every maintenance worker should have and use safety shoes, goggles, and gloves.

Shipping, Storage and Transportation—In these departments most of the injuries are experienced in lifting or moving heavy objects. Foot, toe, hand, finger, back and trunk injuries predominate. Most important from the accident prevention standpoint would be greater attention to the training of employees in safe handling methods coupled with closer supervision to insure that those methods are followed. The general use of safety shoes, however, would reduce the volume of foot and toe injuries and greater use of gloves would avoid many of the hand and finger injuries.

Safety Programs and First Aid Facilities—Details relating to the safety programs and first aid facilities maintained upon the premises were obtained from 58 of the foundries visited in the course of the survey. The variations from plant to plant were too numerous to permit detailed comparisons, but a few significant general comparisons were possible.

Three of the 58 plants had less than 100 employes each, 29 had from 100 to 500 employes, 18 had from 500 to 1000 employes, 5 had from 1000 to 2000 employes, and 3 employed over 2000 workers apiece. The smallest plant had 55 employes and the largest had 3900. The sample, therefore, omitted all very small plants which generally rely upon first-aid kits for injury treatments and rarely employ safety engineers.

No plant with less than 250 employes reported the employment of a full-time safety engineer. However, among the foundries with from 250 to 500 employes each there were 4 which had safety engineers on their payrolls. In the range of 500 to 1000 employes, 6 out of 18 foundries had safety engineers; 3 out of

(*Continued on page* 197)

AO FOUNDRY GOGGLES

SAFETY WITH COMFORT

Put N.F.A. and N.A.S.O. Goggles on your ladlemen so that they can keep their eyes on their work safely, comfortably—steadily.

Super Armorplate lenses have high impact resistance—permit the wearer to work without worrying. Snug-fitting, pliable leather mask and wire-screen ventilation around eye-cups afford maximum comfort and coolness—one-piece headband won't slip or catch in hair.

When ordering, specify either clear lenses or lenses made of glare-absorbing Calobar in medium, dark or extra dark shades. 6 curve Super Armorplate clear or Calobar lenses also available. Catalog No. 304 and 305.

American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS

Where Uniform Core Baking Must Match Faster Output

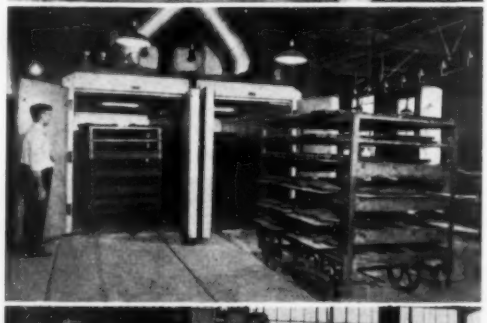
GEHNRICH
CORE OVENS
Are Your Best Bet

For the simple reason that each oven is designed, insulated and heated so that the rates of heat circulation and absorption by the cores or molds and expulsion of volatile vapors are coordinated to effectuate the required baking in minimum time.

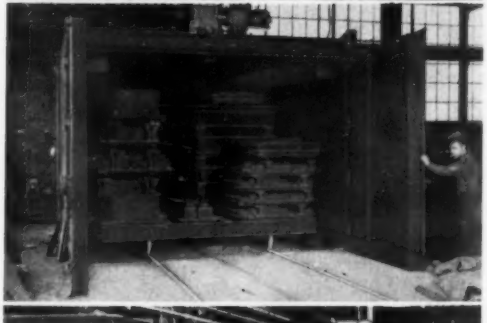
Whether the work load consists of a few small cores per shelf or a car of possibly 100 tons of sand, the Gehnrich method of heat generation, heat recirculation with frequent air changes in large volume, proper facilities for ventilation and temperature control are built into the exclusive Gehnrich Dual Panel Insulated Oven to give your foundry the operating advantages good foundry practice demands.

All this spells uniformly baked cores—produced in minimum time at minimum expense. There's a Gehnrich Oven for every foundry seeking to improve its standards of quality and economy. The performance of installations in many of the outstanding foundries in America can prove this statement.

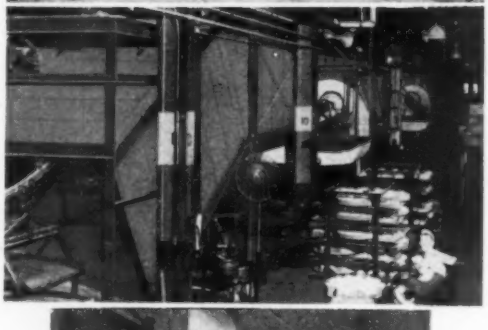
Rolling drawer ovens, heated by recirculation from anintegrally-built oil fired air heater at rear.



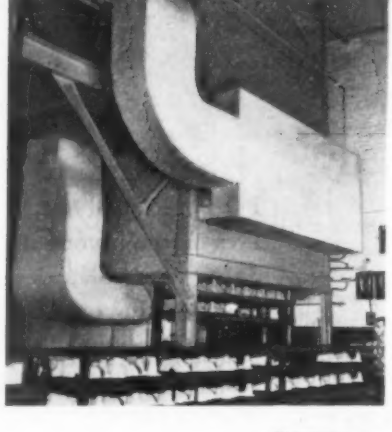
Twocompartment truck loading ovens, convection heated by integral gas fired air heater built at side of one compartment.



Car loading oven uniformly heating heavy mass of molds by recirculating convection from heat generated by an oil fired air heater built into oven at rear.



Long continuous monorail conveyor core pasting oven recirculating convection heated by external gas fired air heaters.



Large tower type conveyor oven, handling a large volume of cores of assorted sizes heated by a unique oil burning and heat distribution system built into the oven.

Write for the Foundry Oven Book

GEHNRICH OVEN DIVISION
W. S. ROCKWELL COMPANY
Batch Type and Continuous Ovens
56 CHURCH STREET NEW YORK 7, N.Y.

CORE BAKING
MOLD DRYING
ANNEALING
HEAT TREATING
BAKING COATINGS
PROCESS DRYING

(*Continued from page* 194)

5 in the 1,000 to 2,000-employe group had safety engineers; and all 3 in the over 2000-employe group had safety engineers.

Each of the 8 plants which had 1000 or more employes maintained first aid rooms on the premises, and all but one of these had either a doctor or a trained nurse on full-time duty. In the 500 to 1000 employe range, 16 out of 18 plants had specially equipped first aid rooms. Ten of these were attended by full-time doctors or trained nurses, 3 were attended by workers who had received Red Cross training in first aid, and 3 were under the supervision of workers who had had no formal training in first aid.

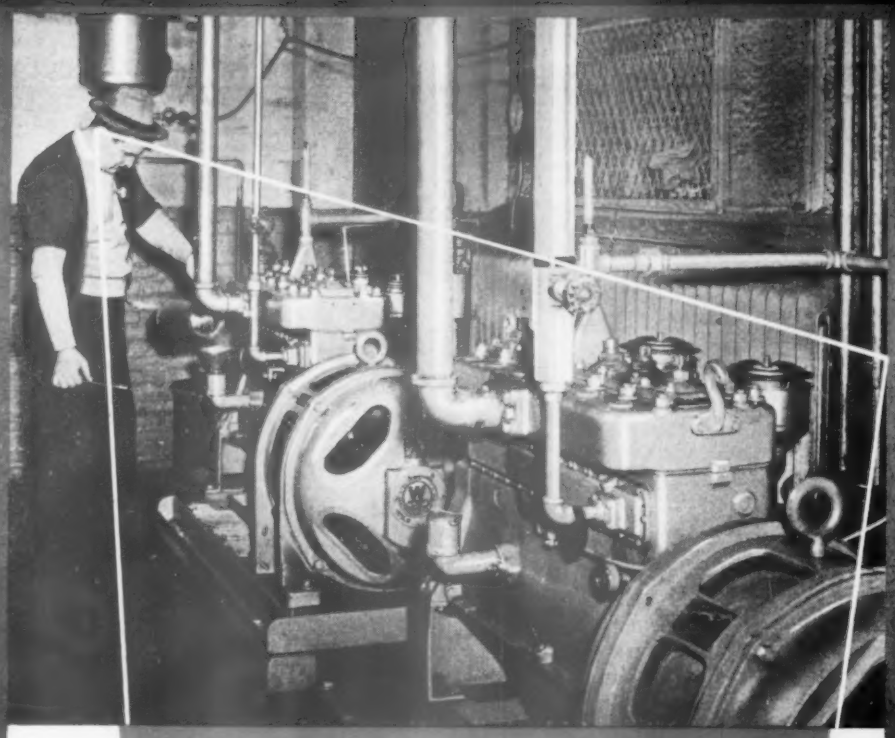
Three of the 32 plants reporting less than 500 employes each had first aid rooms with full time registered nurses in attendance; 8 had first aid rooms with Red Cross trained attendants; and 12 had first aid rooms with untrained attendants.

The striking differences in the injury-frequency rates of these plants graphically portray the variations in the emphasis upon safety indicated by the type of safety leadership and first-aid facilities provided. The 16 foundries which employed full-time safety engineers had an average of 41.3 disabling injuries for every million employe-hours worked, compared with an average of 63.8 for the 42 plants which did not have full-time safety engineers.

Compare Several Records

Inasmuch as nearly all of the plants which employed a full-time safety engineer also employed a doctor or registered nurse to administer first aid, the variations in first-aid facilities in this group involve too few establishments to permit valid comparison on that basis. Among the 42 foundries which did not employ safety engineers, however, the 31 which had first-aid rooms had an average frequency rate of 60.5 compared with an average of 78.8 for the 11 without first-aid rooms. Similarly, within the group of plants with first aid rooms the average frequency rates varied directly with the quality of the supervision provided for the first aid rooms. The best average rate (45.3) was for the six plants which had doctors or trained nurses in attendance. The ten foundries which had first-aid attendants who had been given Red Cross training had an average rate of 65.4, while the 15 plants which had untrained attendants in their first aid rooms had a rate of 71.3.

The individual plant frequency rates varied widely from their group averages and there was considerable overlapping between the groups. Each of the groups included at least one plant which had a rate higher than the highest group average, and nearly all of the groups included one or more plants with rates which were lower than the lowest group average. It is interesting, however, to note that the lowest individual plant rates in the different groups held the



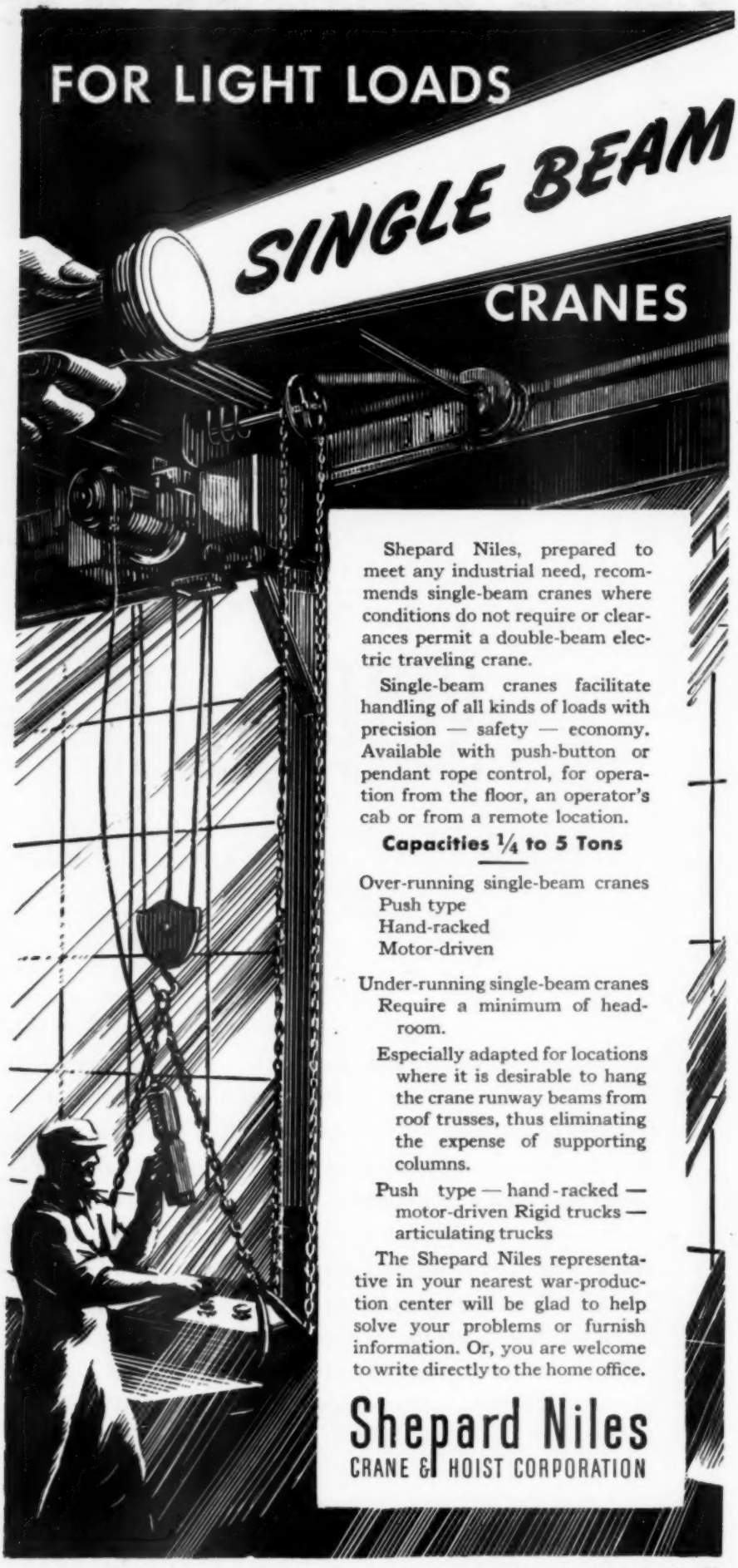
YOU SAVE
WHEN YOU INSTALL
SCHRAMM
AIR COMPRESSORS
IN UNIT SYSTEMS

Here is an interesting illustration of two Schramm Air Compressors at work, furnishing air in a plant where there is regularly a demand for medium amount of air—and an *occasional* peak load which requires a lot of electrical current and air. The two compressors take care of the *variation* of needs for much and little air.

Schramm compressors have 3 outstanding features that make them economical and easy to operate: (1) 100% water-cooled, (2) lightweight and compact, (3) vibrationless, even when providing great amounts of air.

These—and many other features—make Schramm Air Compressors the best compressors for your plant. Write today for full data.

SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA



Shepard Niles, prepared to meet any industrial need, recommends single-beam cranes where conditions do not require or clearances permit a double-beam electric traveling crane.

Single-beam cranes facilitate handling of all kinds of loads with precision — safety — economy. Available with push-button or pendant rope control, for operation from the floor, an operator's cab or from a remote location.

Capacities ¼ to 5 Tons

Over-running single-beam cranes
Push type
Hand-racked
Motor-driven

Under-running single-beam cranes
Require a minimum of headroom.
Especially adapted for locations where it is desirable to hang the crane runway beams from roof trusses, thus eliminating the expense of supporting columns.
Push type — hand-racked — motor-driven Rigid trucks — articulating trucks

The Shepard Niles representative in your nearest war-production center will be glad to help solve your problems or furnish information. Or, you are welcome to write directly to the home office.

Shepard Niles
CRANE & HOIST CORPORATION

360 SCHUYLER AVE. • MONTOUR FALLS, N. Y.

same relationship to each other as that existing among the group averages. The inference to be drawn from these individual plant variations is that many factors other than the employment of a safety engineer or the maintenance of first aid facilities enter into the safety record of individual plants. The direct correlation between the employment of a safety engineer or the maintenance of first aid facilities and the group averages, however, does show that these factors generally do indicate the level of safety existing in particular plants.

(To be continued next issue)

Valve Manufacturers Elect Officers

At a meeting held Feb. 9 at the Biltmore Hotel, New York, W. B. Holton, president, the Walworth Co., New York, was elected president of the Valve Manufacturers Association, succeeding Ernest Cochran, vice president, Chapman Valve Mfg. Co., Indian Orchard.

Other officers were elected as follows: Vice presidents, Lucien W. Moore, Crane Co., Chicago; J. P. Ferguson, Reading-Pratt & Cady Division, American Chain & Cable Co., Reading, Pa.; C. W. Burrage, Lunkenheimer Co., Cincinnati; secretary-treasurer, George A. Cooper, New York.

The following were elected directors: C. C. Chamberlain, Jenkins Bros., Bridgeport, Conn.; Oliver F. Gang, William Powell Co., Cincinnati; C. W. Watson, Detroit Brass & Malleable Co., Detroit; Hugh Foster, Darling Valve & Mfg. Co., Williamsport, Pa.; W. F. Crawford, Edward Valve & Mfg. Co. Inc., Chicago; Ernest Cochran.

MAGNESIUM GRILL: To demonstrate that magnesium is not readily inflammable, Mrs. Connie O'Sullivan, wife of the Memphis, Tenn., fire chief, directs a blow-torch flame against a magnesium grill and its supporting pile of magnesium ingots. The demonstration was a feature at a conference of fire department instructors in Memphis

Workers like the lighter weight of

Mount your patterns on lightweight magnesium match plates and see how favorably your molders respond. Those pounds saved mean that less labor need be expended on useless lifting. The work is easier. There's less fatigue slump during the day.

Where magnesium is used in match plates, core boxes, and jigs and fixtures, weights are often held within legal limits for women workers. This simplifies your labor problems.

Let us help you determine how you can save time and money by employing lightweight Mazlo Magnesium Alloys. Aluminum Company of America, Sales Agent for American Magnesium products, 1720 Gulf Building, Pittsburgh 19, Pa.

MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

The adventures of BILL

BY PAT DWYER

Drawings By Richey

AS A WALKING encyclopedia of facts and figures, one of my able young grandsons aged 11 and as fine a lad as you would meet in a long day's march, indicates now and again that his old time faith in my infallibility is wearing rather thin. Formerly he read the newspapers diligently and then did me the honor of consulting me on various items. For example: Who started the war? What for? Who won World War I? Where is the Baltic Sea? How far is it from here to the South Sea Islands? Why is Christmas in the summer time in Australia? Do kings wear their crowns all the time, or only on Sunday? Did we ever have any presidents besides Washington, Lincoln and Roosevelt? What does the Panama canal look like? The list is practically endless. While I made a valiant stab at some of the answers, I limped a bit on some of the others and had to creep away under a slight smoke screen.

Gradually and almost imperceptibly our positions have been reversed. Instead of asking questions, he voluntarily presents me with items of miscellaneous information. While his manner is perfectly dutiful and respectful, he—probably unconsciously — conveys the impression that the world has made many revolutions since I was a boy, and probably a not over bright boy if the whole truth was known. He fairly drips with useful knowledge and like a homing honey bee, or other comparison that readily will occur to the reader, he has an insatiable desire to deposit his burden some place and go forth seeking for more.

One night recently while tramping home from the neighboring cinema, I heard an airplane passing overhead. Glancing aloft into the dark sky I could see a single small green light, and could hear the roar of her motors as she swiftly disappeared heading west. In the momentary pause I cocked a thumb in a general vertical direction and said "That lad is not losing any time, wherever he is going."

The boy did not either stop or look up. "Liberator," said he nonchalantly, "doing about 300."

Even in broad day light all airplanes look alike to me. They are as alike as a crowd of Chinamen or negroes or a flock of sea gulls. As for estimating speed I knew without looking when the speedometer needle was hovering around 45, but that was at a period when a man could buy a tankful of gas any time he had the price. With a 35 m.p.h. ceiling this past few years, any reminiscent or prophetic speed talk was so much crackling of thorns under a pot. Clearly this was a case worthy of being looked into.

"Just a minute, my dear young relative," I said. "You did not look up. Indeed if you had looked up I doubt that you could see anything beyond a rapidly vanishing small green light. Therefore, on what grounds do you base your statement that the flying machine is a Liberator and furthermore that she is traveling at a speed of 300 miles per hour?"

"Tell by the sound of the motors." Then he added in a tone of mild astonishment, "I thought everyone knew that!"

Some time later I related the incident to Bill. "Apparently," I said, "among other things some one will have to revamp the old standard story about the Boy and his Father."

"What do you mean the old standard story?" Bill inquired. "I bet you if I was pushed into a corner I could quote you maybe 100 standard stories about the boy and his father. Some of them are standard fills in newspaper offices. They pop up occasionally with a claim for originality in magazines of wide circulation. The contributor brazenly claims the incident happened in his own community and that he knew father and son intimately. Public speakers at luncheons, dinners and other time wasting affairs generally manage to drag at least one father and son story out of the hat. I don't know how many times I have heard the story of the Prodigal son, a headstrong young waster and toss pot who came creeping home with his tail between his legs after living for a while and eating with his friends the pigs. Wait a minute," he said, suspiciously, "I hope that is not the story you have in mind."

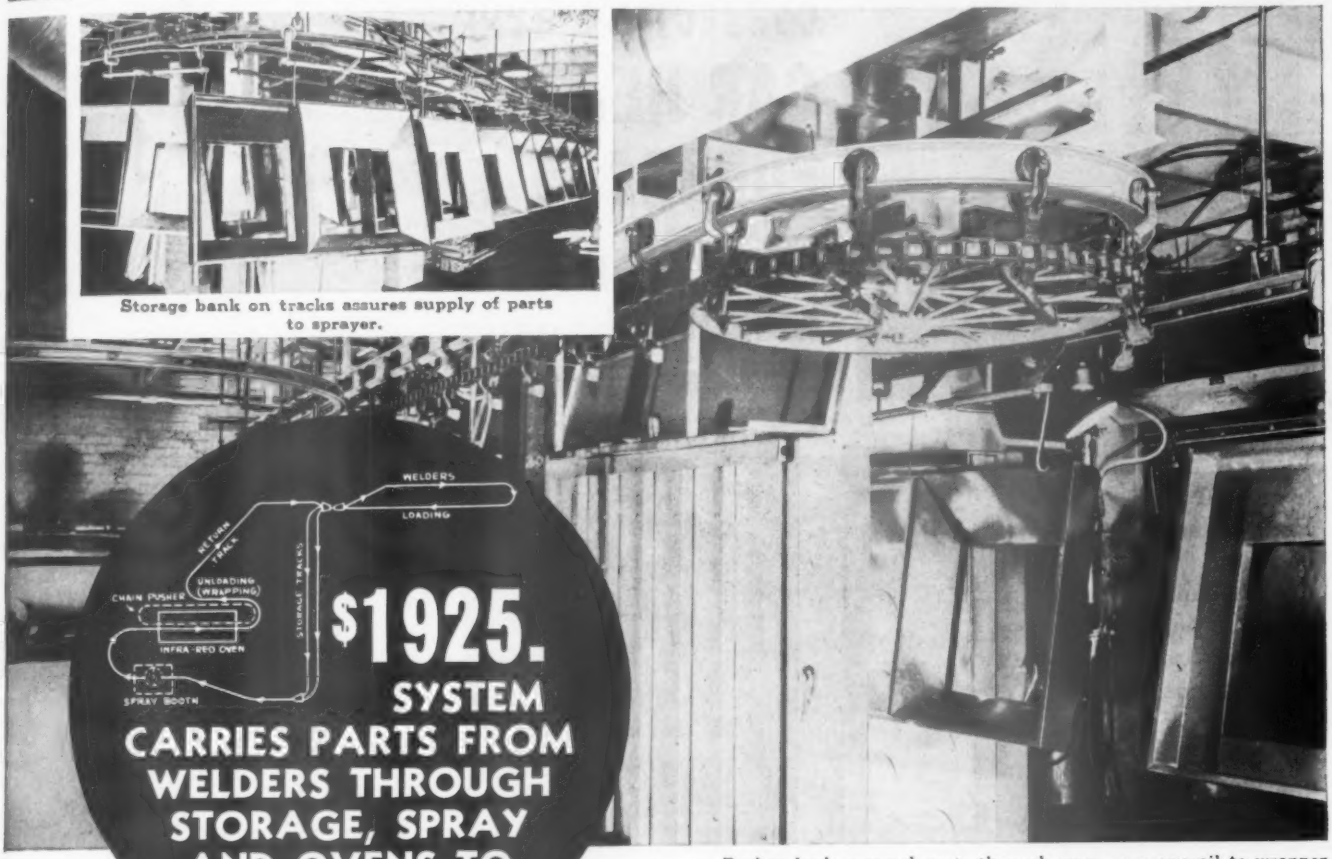
"Pray do not be alarmed," I assured the honest fellow. "That is not the story I have in mind. By a rare fluke of circumstance my opinion and yours run in the same channel on that ancient story. The father probably did take him in, but every time he looked at him he must have experienced a jab of shame instead of the legitimate pride a father should have in a son capable of standing on his own feet, making his own way and ask-

(*Continued on page* 202)

The chairman is wondering which Dopey Joe will move the vote of thanks for the brilliant and inspiring address

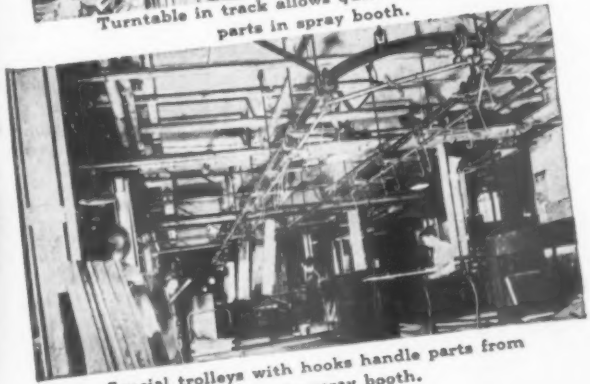
AMERICAN MONORAIL with Infra-Red Ovens CUTS BAKING TIME 70%

Storage bank on tracks assures supply of parts to sprayer.



Pusher feeds sprayed parts through oven on monorail to wrapper.

Turntable in track allows quick movement of parts in spray booth.



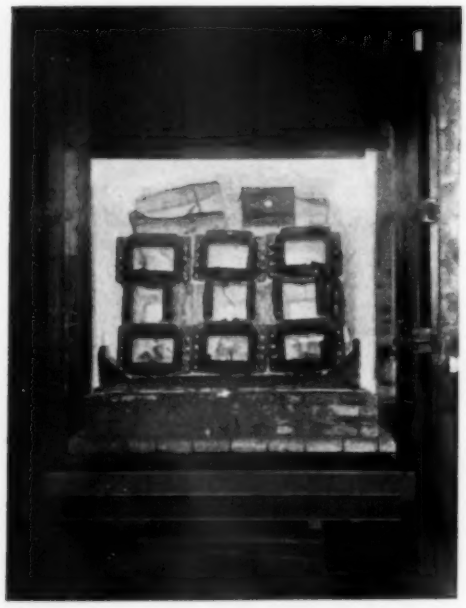
Special trolleys with hooks handle parts from welders to spray booth.

A well known furnace manufacturer has eliminated the bottle-neck in their enameling section with the use of infra-red drying and American MonoRail Overhead Handling System. Where casing sections would pile up in the spray booth, often requiring over 30 minutes—it now takes only 8½ minutes to bake the finishes.

American MonoRail synchronizes all pre-baking operations with baking time. The system extends from the sheet metal section, through spraying, baking, wrapping and returns to fabricating and welding stations. A turntable in the track permits reversing of carriers holding the pieces so that operator may spray all sides without touching the sprayed surfaces.

Our engineers will gladly show you how your products can be carried at the lowest possible cost and the highest possible efficiency.

THE AMERICAN MONORAIL CO.
13104 ATHENS AVENUE CLEVELAND 7, OHIO



VULCAN

DIRECT FIRED AND CONVECTION TYPE CAR HEARTH FURNACES...

Built to Handle Maximum Loads in Less Time...

View at right shows two VULCAN Car Hearth Furnaces for complete treatment of miscellaneous castings . . . one, at left, is direct fired; other is convection heated. Illustration above shows fully - loaded car leaving direct fired unit.

In this modern VULCAN installation, the direct fired furnace is used for annealing and normalizing at temperatures up to 1800°F. Convection furnace is used for stress relief, at a maximum of 1300°F. Each furnace is equipped with complete program control, including rates of heat rise and cooling; motorized car and door; and transfer car control. Five cars and one transfer car were furnished, all interchangeable with both furnaces, providing an exceptionally flexible heat treating unit.

Continuous operations at maximum capacity; a shorter over-all treatment cycle; uniform temperature at all points on the work; and important savings in operating and maintenance costs are among the advantages resulting from installation of furnaces designed and built by VULCAN. Inquiries concerning your requirements will be given prompt attention.

The outstanding success of VULCAN furnaces in many important war production plants, is proof of the soundness of their design and construction. All types can be equipped for oil, gas or electric heating.

VULCAN CORPORATION
1797 CHERRY STREET, PHILADELPHIA, PA.

(*Continued from page* 200)

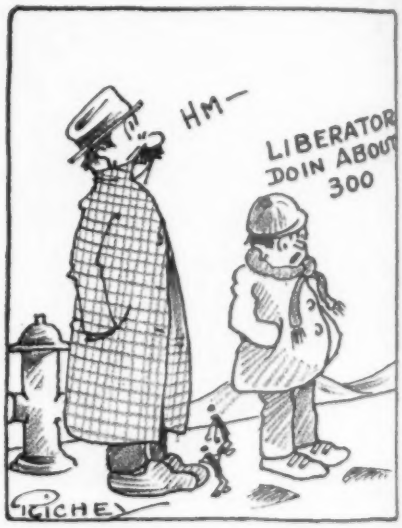
ing favors of no one. Invariably we are asked to bestow all our sympathy on the son, when as a plain matter of fact and of simple justice, the father is the more deserving party.

"However, the story I have in mind in the present instance has none of the harrowing and obnoxious features which drove me into the opposite camp to that of the Prodigal Son practically the first time I heard a professional hand it out with—with—"

"Go ahead and say it. With big gobs of goo!"

"Bill," I said, "I don't know where you pick 'em up, but certainly you have some highly satisfactory words in your vocabulary."

Bill turned in his toes, placed the tip of one index finger in his mouth, and cast his eyes down modestly in what he was pleased to imagine the attitude of of a shy little maid accepting the congratulations of an admiring family circle on her ability to spell c-a-t, cat for the first time.



Junior spills a bit of technical dope

"Oh, well," he admitted, "the foundry is a great place for picking up little gems of that kind. Some of the words indicate a remarkable familiarity with the Deity, but on the other hand as you might say, many other words and expressions indicate a singular lack of knowledge on the part of the late Mr. Webster when compiling his dictionary. Maybe he omitted them on purpose. Old Web knew his way around. Maybe he knew that story you have been smuggling around, up your sleeve for the past half hour. I hope it is one that would meet with the approval of Mr. Webster."

"So far as I know," I said, "he may have written the thing, although the theme and general style incline me to the opinion it may have appeared first in the onetime best seller *Poor Richard's Almanack*, by Benjamin Franklin. Anyway here it is.

"When a boy is 10 years old he be-

(*Continued on page* 204)

2 ways To Quickly Overcome Casting Defects And Eliminate Guesswork . . .

1 USE THE CASTING DEFECT CHART
2 USE SAND TESTING EQUIPMENT

DIETERT CASTING DEFECT CHART

CASTING DEFECT	FINENESS		MOISTURE		PERMEABILITY		GREEN STR'GTH		GREEN
	CAUSE	REMEDY	CAUSE	REMEDY	CAUSE	REMEDY	CAUSE	REMEDY	CAUS
BLOW	FINE	REDUCE CLAY BALLS AND FINES. INCREASE GRAIN SIZE	HIGH	REDUCE MOISTURE	LOW	REDUCE FINES OR INCREASE GRAIN SIZE TO INCREASE PERMEABILITY	high	reduce clay substance or binders. Increase aeration	
DROP			low or high	control moisture			low	increase clay Bentonite or new molding sand	
SCAB	FINE	INCREASE GRAIN SIZE. REDUCE FINES	high	reduce moisture	low	increase grain size or reduce fines			

MOISTURE TELLER

THE CAUSE of a casting defect is not always a singular condition but rather a series of conditions. Frequently, one or more *direct* causes and one or more *indirect* causes collectively cause a casting defect. However, certain conditions might prevail that would make it advisable to alter the indirect causes of a defect and make no alteration to change the direct cause. Very often, alteration of a single indirect cause will change mold conditions sufficiently to eliminate a casting defect.

The types of mold conditions causing various casting defects chargeable to sand and the method of remedy for these defects are tabulated in the CASTING DEFECT CHART. IF YOU HAVE NOT ALREADY RECEIVED THIS CHART, WRITE FOR YOUR FREE COPY TODAY.

★ ★ ★ ★

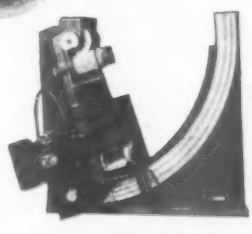
Prepare all of your foundry sands to definite specifications as measured by sand testing equipment so that the same sand is delivered daily to the molding units.

Write today for information on an economical sand control set-up for your plant.

PERMEABILITY METER

TEST CORE BAKING OVEN

MOLD HARDNESS TESTER



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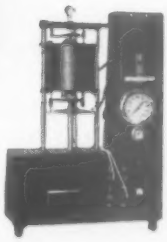

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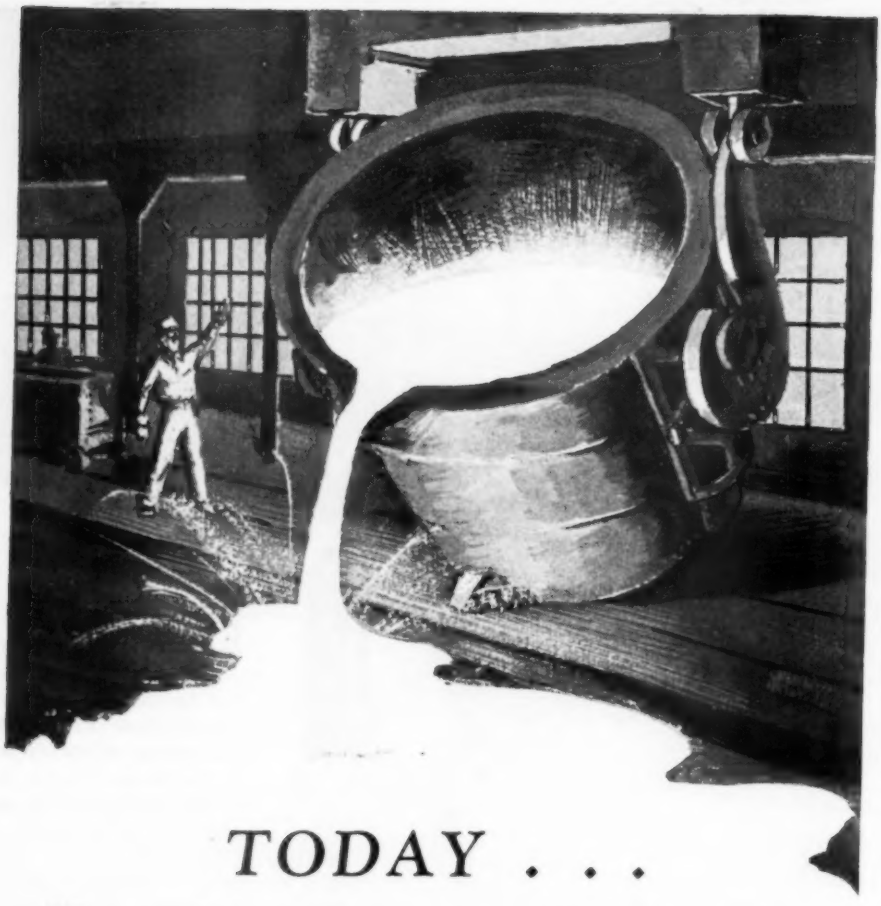

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(*Continued from page* 202)

lieves that his father knows more than any other person in the world. When he is 15 he begins to have doubts. He notes many little things that do not meet with his entire approval. When he is 20 he is quite certain that the old man is a hopeless mossback. Utterly mistaken in practically all his opinions. By the time he is 30 he begins to think that perhaps the old boy is not so far out. By the time he is 40 he is quite willing to defer to his father's ideas and when he is 50 and his father is dead he proudly proclaims to one and all that his father was the best and wisest man he ever knew."

"Talking about fathers and sons and one thing and another," Bill said, "I had a rather peculiar letter recently from a young man who craved a little light on some of the strange terms used in the foundry. He wrote a nice scholarly hand and in a general way I gathered the impression that he had been brought up in a manner that shielded him from direct contact with the proletariat. He may have entered the foundry eager and anxious to learn and then had his sensitive feelings ruffled when some of his innocent questions gave a hardened character the opportunity to spring some of the rude stuff that passes for humor in the foundry. He wrote me as follows: 'As a beginner in the foundry I am puzzled by some of the shop terms. For example, new sand shipped into the foundry is yellow. The sand in all the heaps and in all the molds is black. According to a recent optical examination I have normal vision, the ability to distinguish one color from another. Therefore I am at a loss to understand why every person in the shop refers to the material as green sand, and to all the molders as green sand molders'."

"A very good question indeed Mr. Howard," I could not help the interruption. "A very good question indeed: Why is green sand called green sand? Coming as it did about March 17 I suppose you told him that the molding and casting trade was invented in the little green isle, away back before the days of Brian Boru, when everything was green from Malin Head to Cape Clear and from Liffey to Connemara."

"Well," said Bill, "I'll tell you. I wrote this disciple seeking the green light to go ahead, the first and normal reaction to his question was to counter with the popular standby of radio, stage and screen 'Are you kidding'? The second reaction was to wonder mildly if a new type of boy is entering the foundry, a boy with the innocence and naivete to ask such a question. However, in the event that the age of miracles is not past and that the question was asked in good faith, I would be the last person in the world to treat it flippantly. Also I had the example of the famous editor who took time out to answer a little girl's question on what to her was a very important subject. He wrote about 200 words in support of

(*Continued on page* 206)

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(*Continued from page* 204)

his statement to the little lady, 'Yes, indeed, Virginia. There is a Santa Claus!'

"Continuing I explained that the term green sand as applied in the foundry does not refer to the color. It refers to the condition as touched upon very neatly and completely by the late Mr. Webster—Noah or Dan, I forget which—in his well known work of reference. Donning the old horn rimmed spectacles and skimming rapidly through more than a solid column of greens we light upon this illuminating paragraph: 13—Not seasoned; raw, specifically of liquors not matured or mellowed by keeping; of wood not dried of sap; of sand in founding; clay in ceramics, starch, sugar, etc., not dried; moist; of cement or concrete not completely set; of an inking roller (in printing); freshly cast; unseasoned; of fish or flesh, etc., freshly caught or killed, or not completely cured; of pelts, etc., (in tanning) fresh from the animal; not baked or roasted, raw or partly raw as green coffee, hence unfired as green bricks, green pottery.

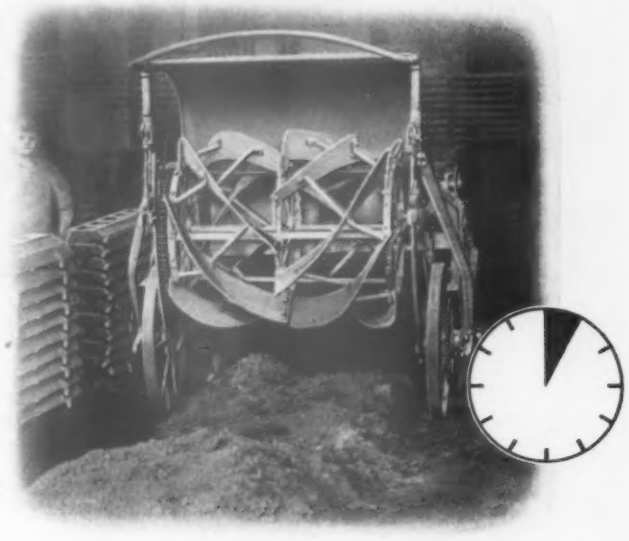
"With all the foregoing in mind it should not be difficult to understand how the term became incorporated in foundry nomenclature. A nomenclature, by the way, that includes such mysterious terms as a bot for plugging the tap hole in a furnace; a nowl or drag for the lower part of the mold; a flask for the wood or metal frame enclosing the sand in a mold; gaggers; soldiers; whistlers; the peen end of a rammer; mold or core wash which is not a wash but a coating; tuyeres; chaplets; anchors; crabs; and loam which invariably is pronounced loom. A cupola almost without exception is known as a Q-bil-O with the accent on the first and last syllables.

"Obviously, any man attempting to trace the origin of these words through our own and through foreign languages would need to have the lives of at least one and possibly two healthy, husky tom cats equipped with special reinforced carbide tipped nails for scratching and rooting in the ashes and slag dumps of ancient cities buried for thousands of years in the land of Egypt, under the windy plains of Troy, in Babylon and in Ur of the Chaldees.

"He would not need to go back quite that far to find the origin of the term green sand. According to meager available records the early foundrymen dried all their molds before they filled them with bronze. It is quite probable that the idea of using green sand first occurred to some brave lad after he had seen molten iron running from a primitive blast furnace into a pig bed, some time in the 14th century. The word passed around by the usual grapevine telegraph and the peripatetic prowling habits of journeymen molders and casters. Credit for development of the blast furnace for melting iron goes to Germany. One easily can imagine a rambler from the fatherland landing in a British foundry and announcing casually to the gang sitting around the sala-

(*Concluded on page* 208)

HANDPOWER or HORSEPOWER



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(*Concluded from page 206*)

mander at noon time: "In my country, iron into sand molds totally undried is cast." This naive statement is greeted by a sneering laugh from one and all. One outspoken lad cheerfully offers to eat all the castings the stranger can make in a week in green sand molds. Fortunately his offer was not taken up. Gradually the practice spread to all foundries. Many men still active in the foundry industry can remember when the first timid and tentative attempts were made to cast steel in green sand molds. Today, although no actual figures are available, it is probably safe to say that a greater tonnage of steel is poured into green sand molds than is poured into molds that are dried in the oven.

Book Review

Foundry Sand Testing Handbook, cloth, 176 pages, 6 x 9 inches, published by the American Foundrymen's Association, Chicago. Price $3.50.

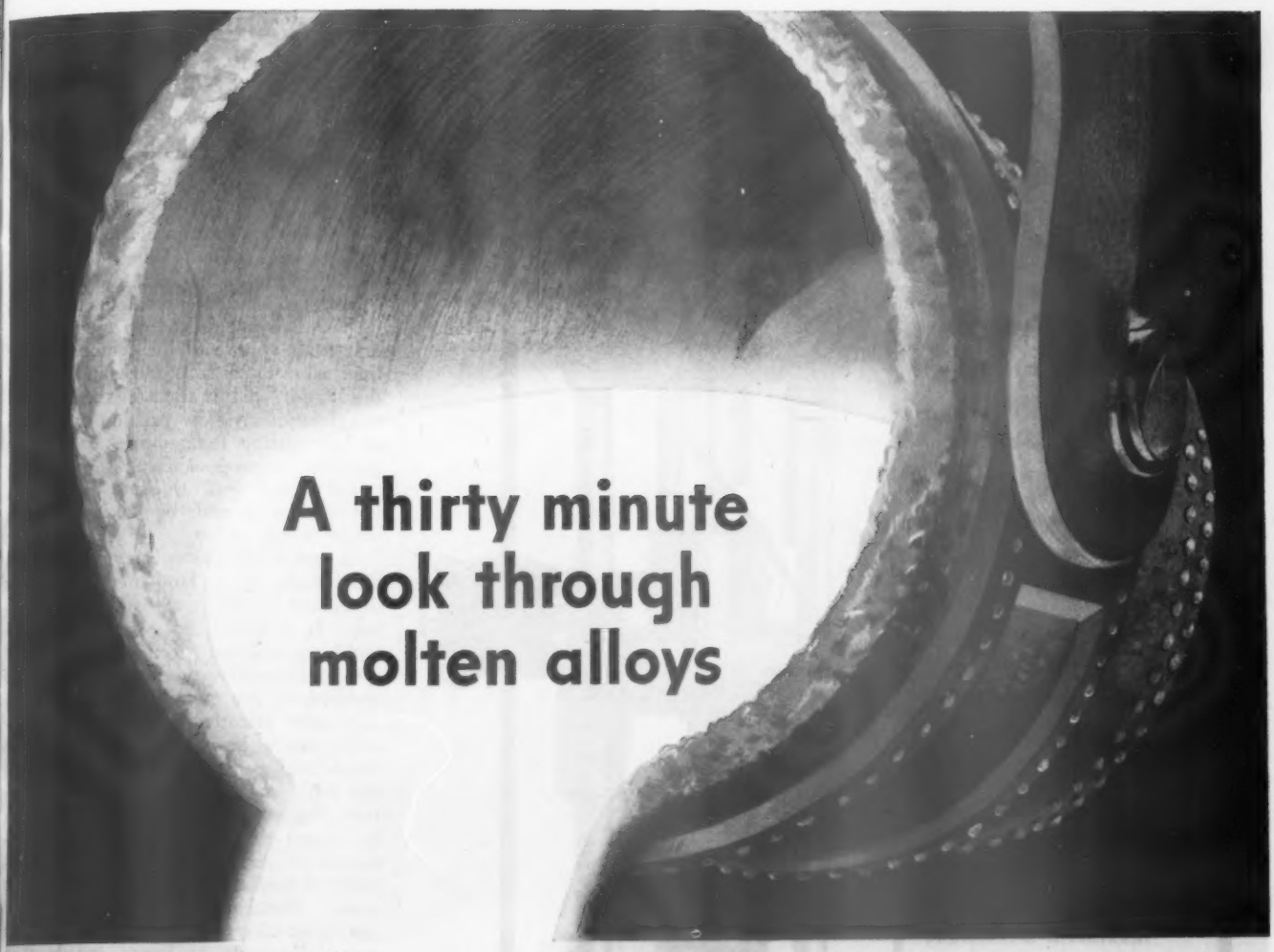
This is the fifth edition of an authoritative work on foundry sand testing prepared by the American Foundrymen's Association, and has been revised completely to incorporate all the changes and developments since the last publication in 1938. Those procedures no longer employed have been eliminated. The book includes all standard and tentative standard methods developed, and also certain nonstandard methods which are being used and studied as possible applications.

Contents of the volume are divided into 22 sections which cover methods of sampling, and preparation of sands and test specimens, and detailed descriptions of methods of testing for various properties of green and dry sands such as moisture, strength, permeability, sintering point, fineness, hardness, etc. Information also is given on equipment. Final sections of the book comprise an extensive bibliography and index.

Issues Bibliography

College of Engineering, University of Iowa, Iowa City, Iowa, has published an 80-page "Bibliography of Industrial Engineering and Management Literature," prepared by Prof. Ralph M. Barnes and Norma A. Englert. The book is divided into four sections containing books and bulletins, articles and papers, abbreviations of magazine titles, etc., and an index. All items are listed under authors' names in alphabetical order with a number. Index is by subjects under which the numbers of the articles are listed. Copies of the book may be secured from the College of Engineering for $1.50.

Crown Iron Works, Minneapolis, has been awarded a second star for its Army-Navy "E" flag for continued excellence in war production.



A thirty minute look through molten alloys

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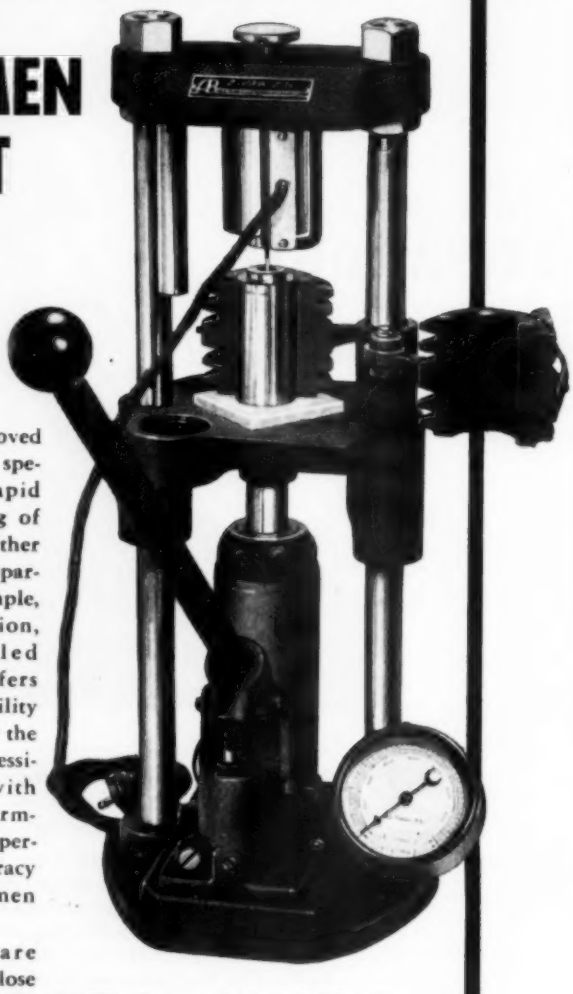

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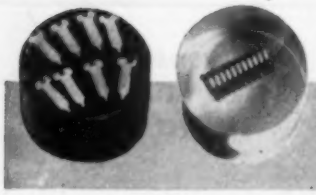

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CENTRIFUGAL CASTING SPEEDS

(*Continued from page* 106)

metal, a demonstration of this effect can be obtained readily. When a large volume of metal is poured into the mold rotating at constant speed, the whole of the metal is not picked up immediately. As time elapses and the temperature of the molten metal falls, more and more of the liquid steadily acquires the rotational velocity. By slow pouring or the use of low casting temperatures it is often possible to produce castings of exceptional radial wall thickness at speeds lower than would be necessary with hotter metal.

In one of the Lavaud patents,[7] a metal mold built up in laminated sections is described to obtain more effective cooling. It is stated that with the normal mold construction for the production of a 6-inch diameter pipe a speed of 1200 revolutions per minute was necessary, the more effectively cooled mold enabled this to be reduced by half to 600 revolutions per minute. The nature of the mold material, apart from its surface character, can exert an influence on the speed conditions required by acceleration by reason of its thermal conductivity through its effect in cooling the metal. Metal molds for this reason may enable acceleration to be brought about more effectively at lower speeds than sand molds.

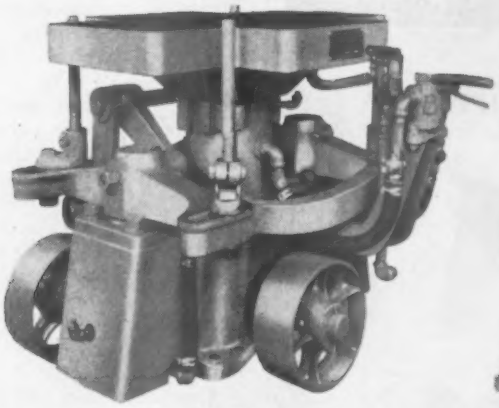
Metal Has Initial Velocity

In all centrifugal casting processes, the molten metal introduced into the mold has a certain initial velocity. Obviously, if this velocity at the point of application to the mold is identical in magnitude and direction with that of the mold itself, then the previous considerations of surface friction and viscosity vanish. This condition can never be quite secured in those cases where molten metal is allowed to issue in a continuous stream from a pourer spout on to the internal surface of a rotating mold.

For example, in the case of rotation about the horizontal axis, the metal stream issuing from the pourer spout describes a parabolic path. For the condition of identity in direction of the mold velocity and stream velocity, it is necessary for the tangent to the parabolic path to coincide with that of the circle representing the surface of the mold at the point of meeting. This condition cannot be met exactly with any parabolic path inside the circular path of the mold surface (see Fig. 1). The shape of the parabolic path, and the point at which it meets the mold surface for any given position of pourer spout, are determined by the initial velocity of the metal stream.

The relationship of these and the final velocity at the point of impingement on

(*Continued on page* 212)



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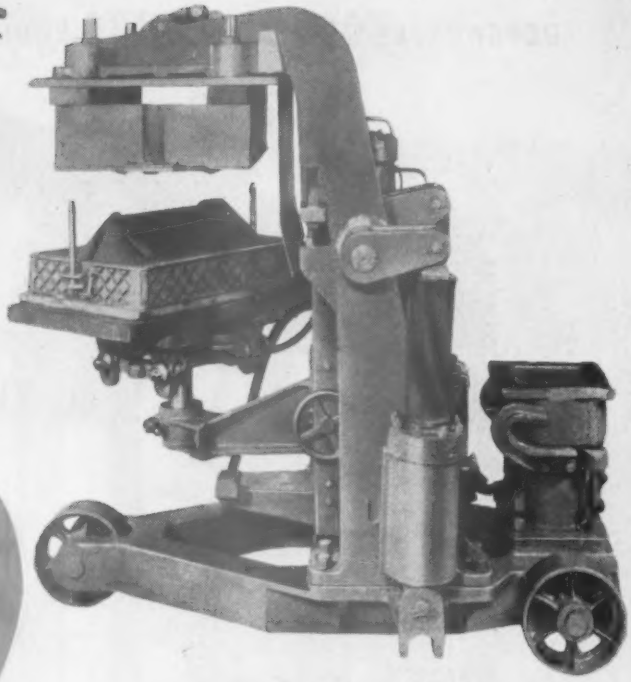

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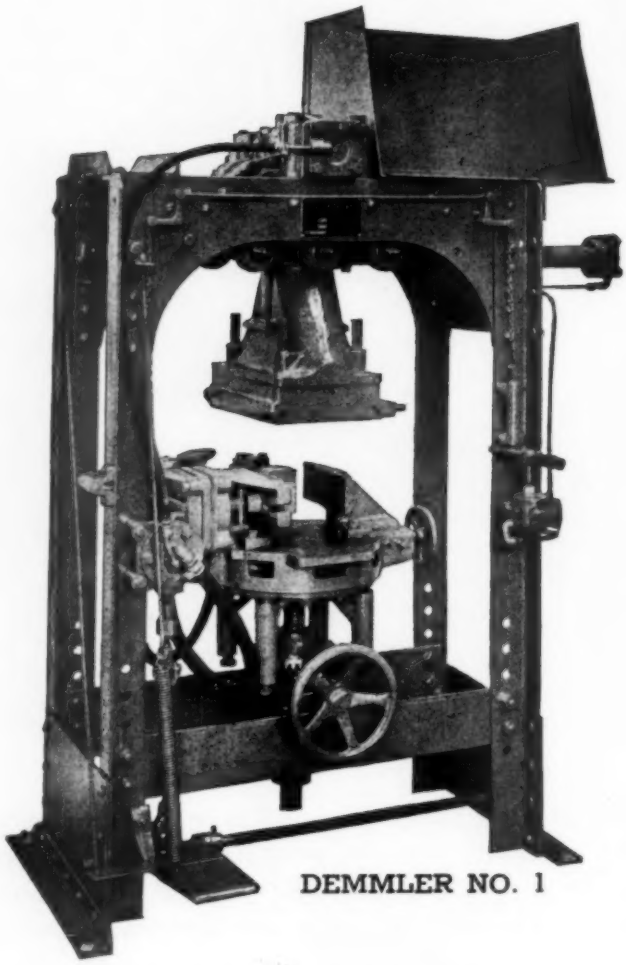

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(*Continued from page* 210)

the mold surface is connected by the well-known equations,

$$S = ut + \tfrac{1}{2}gt^2$$
$$V^2 = u^2 + 2gS,$$

Where u = initial stream velocity; g = acceleration due to gravity; t = time in seconds; V = final stream velocity, and S = length of parabolic path.

Fig. 1 illustrates the effect of initial stream velocity on the shape of the parabolic path, the meeting point of the metal stream and the rotating mold surface, and the final stream velocity at this point for various positions of pourer spout in a 36-inch diameter mold rotating about the horizontal axis.

The importance of these considerations on the velocity of the stream of metal is sufficiently illustrated by this diagram. The further considerations, such as shock losses and turbulence arising out of this, are more properly considered in connection with pouring methods. They are of interest in connection with any discussion of rotational speeds in that they in part determine the desirability of centrifuging after filling or the adoption of low starting speeds in certain of the various types of centrifugal casting processes. Centrifuging after filling the mold is often practiced in some of the processes of semi-centrifugal or pressure centrifugal casting.

Practical Difficulties Exist

In the case of true centrifugal castings, it is more difficult, but the introduction of all the molten metal into the mold whilst stationary or rotating at very slow speeds followed by acceleration to the predetermined final stream, is a method of obtaining close similarity between the molten metal and the rotating mold velocities. Obviously, the practical difficulties in adopting this method are least in rotating about the vertical axis and become greatest in rotation about the horizontal axis.

An example of a process of this type is to be found in the early sand-spun machine of W. D. Moore.[8] This machine, illustrated diagrammatically in Fig. 2, shows the mold arranged initially in a slightly inclined position. An inclination of about ½-inch to the foot was recommended. Provision was made for this mold to be lowered gradually to a horizontal position during casting or spinning the molten metal. In operation the whole of the molten metal could be introduced into the mold either with the mold revolving or stationary, and at the same time the metal caused to distribute itself uniformly over the mold surface with a minimum amount of surge by lowering the mold to the horizontal position and accelerating the rotation speeds. In one description of this machine,[9] it was recommended that rotation was commenced at 50 revolutions per minute during the pour. The time taken in lowering to the horizontal position should be about 20 to 25 seconds. On attaining the horizontal position, the speed was increased to 1250 revolutions per minute, this being maintained for a

(*Continued on page* 214)

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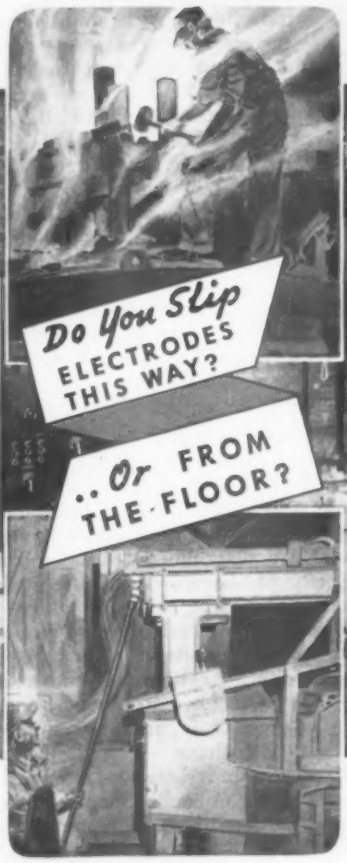

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(*Continued from page 212*)

period of 2 minutes, after which the speed was reduced to 900 revolutions per minute for a further 3 minutes prior to stopping and removing the mold. These figures refer to the casting of standard spigot and socket cast-iron pipe.

The foregoing remarks draw attention to the factors concerned with acceleration which have an influence on the rotational speeds. The manner in which the molten stream is applied to the mold, the character of the mold surface and material whether metal or sand, all are of importance in determining the time required to accelerate the molten metal to the rotational velocity of the mold. For example, in sand molds or in molds which are maintained at high temperatures, the period required for the solidification of the molten metal is prolonged. In these cases the allowable time limit for the acceleration of the liquid metal is likewise prolonged.

The external form of castings produced by rotation of molds about their own axes is governed by the shape of the mold walls. The internal form and the distribution of pressure within the liquid metal are determined by the rotational velocity of the speed and the angle of inclination of the axis of rotation. The shape of the internal liquid surface when rotation is performed about the horizontal axis is cylindrical, and rotation about axes inclined to the horizontal or vertical results in an inner surface of parabaloidal shape. The derivation of the relationships between rotational velocity, angle of inclination, and internal form has been dealt with previously by the author.[10] Reference can be made to this, and several other treatments of this subject as for example Cammen[11] and Wood.[12]

In the case of rotation about the vertical or inclined axis and referring to the diagram, Fig. 3, for rotation the dimensional relationships in terms of speed of rotation N (r.p.m.) are related by the equations 1 and 2.

$$N = 423 \text{ (approx.)} \sqrt{\frac{1}{r_1^2 - r_2^2}} \times \sqrt{H \sin \alpha}$$

Metric units (cms.) ..... (1)

$$N = 76{\cdot}25 \text{ (approx.)} \sqrt{\frac{1}{r_1^2 - r_2^2}} \times \sqrt{H \sin \alpha}$$

English units (feet) ..... (2)

The speed of rotation and dimensional relationships are independent of the weight of the molten metal, and they vary with the sine of the angle of inclination to the horizontal. For the same internal surface dimensions the inclined axis enables a lower speed of rotation to be used than the vertical axis.

The corresponding relations for the case of rotation about the horizontal axis in reference to Fig. 4 are given in equations 3 and 4.

$$N = 54 \sqrt{\frac{1}{R - R_1}}$$ English Units (feet) .... (3)

(*Concluded on page 216*)

Stearns

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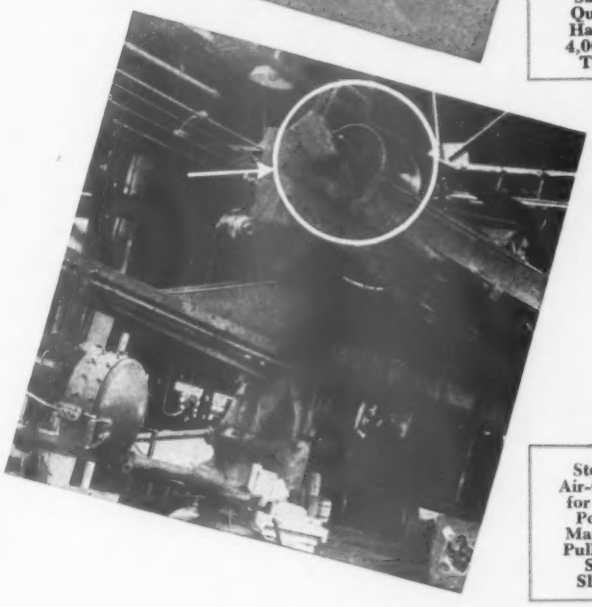
for the FOUNDRY INDUSTRY

Stearns Lifting Magnet Safely, Quickly Handles 4,000-lb. Track



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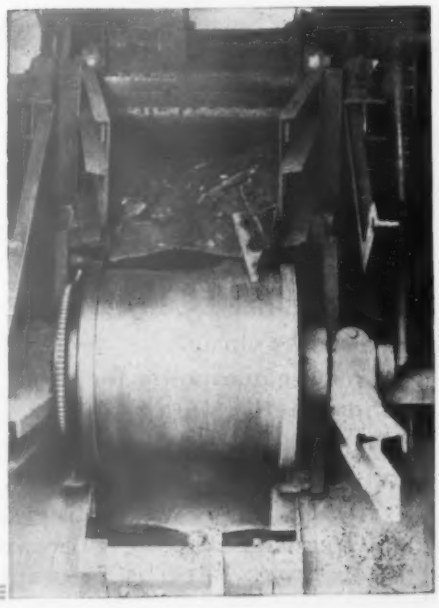

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BRAKES PULLEYS

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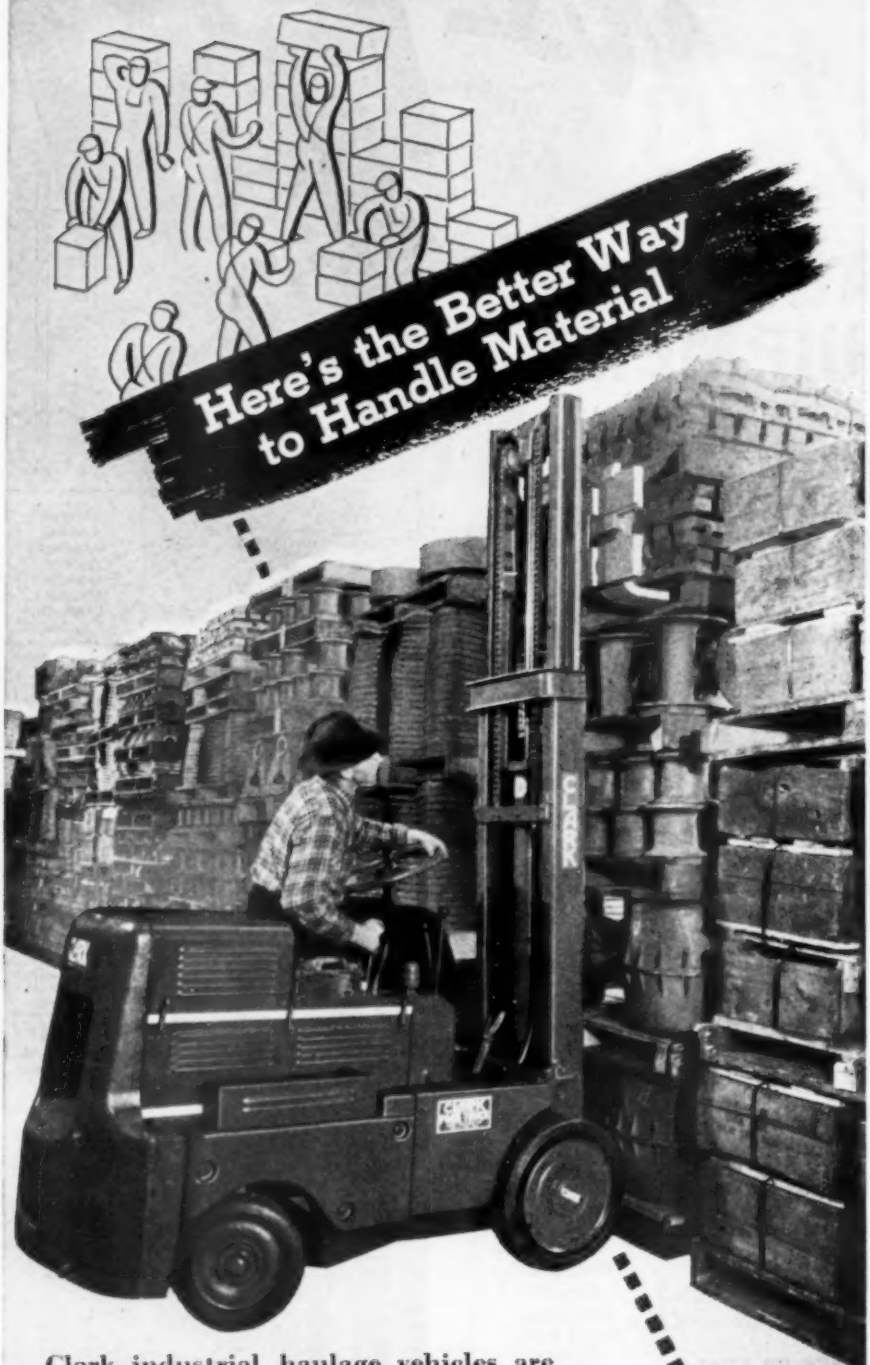
TO A PRODUCT EXCEPT COST



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INDUSTRIAL TRUCKS AND TRACTORS • HIGH-SPEED DRILLS AND REAMERS
METAL SPOKE WHEELS • GEARS AND FORGINGS • RAILWAY TRUCKS

(*Concluded from page 214*)

$$N = 300 \sqrt{\frac{1}{R - R_1}} \quad \text{Metric Units (cms.)} \quad \ldots (4)$$

The centrifugal force acting on unit volume of liquid metal is "mw^2r," where "m" is the mass of unit volume of metal, "w" the angular velocity (in radius), and "r" the distance of the unit from the axis of rotation. In a uniformly rotating mass of liquid metal, as for example a cylindrical mass, the pressure due to centrifugal force at any point within the mass, is thus

$$\int_{r_1}^{r} m w^2 r \, dr$$

where r_1 is the internal radius of the cylinder. Integrating the pressure at a distance r from the axis of rotation gives the relationship

$$P = \frac{m w^2}{2} (r^2 - r_1^2) \quad \ldots (5)$$

For given conditions of angular velocity in a given casting the pressure due to centrifugal force is lowest at the internal surface r_1, and increases as the distance from the axis of rotation r to a maximum at the outside diameter of the given casting. A pressure gradient is thus established from the outside to the inside surface, radially across the radial wall thickness of the casting. Insoluble particles, for example, slag in liquid metals whose density (m) differs from that of the parent metal, are subject to a different pressure at a given velocity, a fact which accounts for the movement of these particles under centrifugal action. These are the factors which play such an important part in determining the soundness of castings produced by the centrifugal process.

(*To be concluded next issue*)

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10. Speed of Rotation in the Centrifugal Casting Process. J. E. Hurst, *Foundry Trade Journal*, Sept. 3, 1931.
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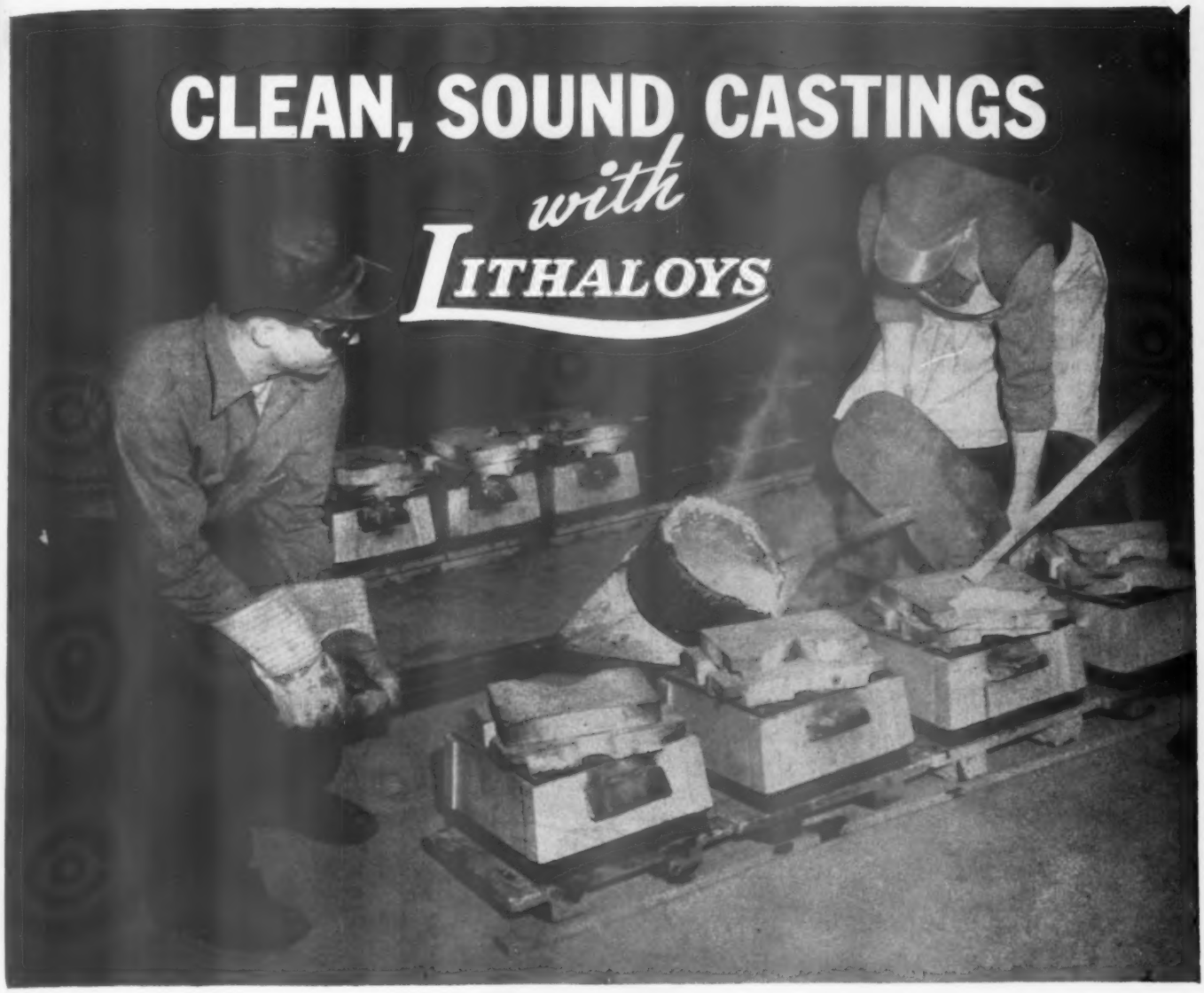
Opens New Office

Despatch Oven Co., Minneapolis, has opened a new sales and field engineering office in Chicago. John H. Watson has been appointed general manager of the new office with headquarters in the La Salle Wacker building, 221 North La Salle street.

CLEAN, SOUND CASTINGS *with* LITHALOYS



LITHIUM treated melts of copper, tin bronze and silicon bronze consistently yield castings more uniformly free from porosity and gas cavities. At the same time, Lithium treatment effectively removes non-metallic impurities. As a result, the castings have optimum physical characteristics.

Lithium treatment is simple. A few minutes before pouring, Lithium metal is stirred into the melt in the form of a stable master alloy containing a small percentage of Lithium combined with other metals to match the melt.

Lithium combines with hydrogen, nitrogen, oxides, sulphides and other non-metallic impurities. The compounds so formed are of non-metallic nature, and have low specific gravity. They are insoluble in the metal and flux out quickly.

This effective treatment costs only a small fraction of the price of *one* reject, and requires no special equipment, training nor departure from conventional foundry practice. Our technical staff, with over 15 years' experience in the Lithium and foundry fields will help you investigate.

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WASHINGTON Notes

WPB has placed a 60-day supply limit on consumers' inventories of cast iron scrap, including home scrap, in an attempt to forestall hoarding of this relatively scarce commodity. Many foundries have had nothing like a 60-day stock on hand, but WPB claims that inventory reports revealed others had excessive supplies and were attempting to buy more, thereby aggravating the overall shortage. No improvement in scrap supply is in sight, what with the lag in junking of old machinery and automobiles and the manpower restrictions on scrap collection and preparation.

★ ★ ★

Shortage in scrap is reflected in sharply increased demand for pig iron in some areas. This has revived talk of the possibility of putting pig iron back on allocation, although it is thought highly improbable that this will be necessary. Pig iron production early this year was well below 90 per cent of capacity, the comparatively low rate having been caused partly by severe weather.

★ ★ ★

POSTWAR uses of aluminum and magnesium were aired before a Senate subcommittee recently by various consumers and producers. The occasion was a hearing by the Small Business Committee's subcommittee which is studying surplus war property disposal, its interest in the light metals being caused by the fact that aluminum and magnesium producing plants bulk rather large in government-financed construction which some day will be surplus war property.

★ ★ ★

Testimony on probable applications of light metals after the war was more extensive than the recommendations as to what should be done with the producing facilities provided by the Defense Plant Corp. Engineers of automobile and farm implement companies detailed the metallurgical advantages and disadvantages of magnesium and aluminum compared with ferrous metals for specific applications, but pointed out that price relationships—at present indefinite—will be the most important single factor in deciding the ratio of metals consumed.

★ ★ ★

AS ONE motor car representative flatly put it: "When aluminum costs over 6 cents per pound, no aluminum casting can compete in price with iron castings except where the costs of machining are relatively high." However, he also stated that even with secondary aluminum selling at 8 to 12 cents a pound the metal could be used to advantage (improved performance or lower machining costs through use of die castings) for certain items, such as engine pistons, distributor housings, timing gears, governor bodies, brake pistons and end plates for starters and generators.

★ ★ ★

There was universal agreement at the Washington hearing that government control over magnesium and aluminum producing facilities should be relinquished with passing of the war emergency, although Dr. Willard H. Dow also suggested that some plants be set aside and kept in standby condition for purely munitions purposes. Opposition was voiced against the government's subsidizing of light metal production at artificially low

(*Concluded on page 220*)

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THE speed, economy and efficiency with which the BUDA Chore Boy performs its missions has made it increasingly popular among foundrymen. Rough castings, sand, coke and coal, etc., are hauled with a minimum of manpower and expense. Bulk material handling problems are simplified when you use this sturdy Chore Boy and spacious dump hopper with foolproof rocker and locking mechanism. Send for full data.

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DIESEL NOZZLE TESTER

(*Concluded from page 218*)

prices, this protest coming from E. E. Wilson, vice chairman, United Aircraft Corp. He stated that such action would "freeze" light metals as the aviation industry's chief raw material and would automatically remove one of the great spurs to competitive aviation research.

★ ★ ★

INCREASED steel demand for war production has resulted in a 23.5 per cent cut in amount of carbon steel allotted by WPB for second quarter use in manufacture of durable goods. Allotments to makers of items used solely or mainly by civilians have been reduced by correspondingly higher percentages, and in some cases will result in insufficient material being available to meet second quarter production programs previously approved.

★ ★ ★

Heavier military needs for aluminum will permit producers to make available little or no material against deferred allotments assigned to manufacturers of aluminum cooking and household utensils in the second quarter.

★ ★ ★

DECLINE in production of cast iron soil pipe and fittings from approximately 535,000 tons in 1941 to 165,000 tons in 1944 has caused the supply situation to be "seriously short," according to WPB. The industry had unfilled orders of 95,000 tons at the opening of this year, and 1945 requirements are expected to be about 225,000 tons.

★ ★ ★

Machine tools may continue to be a bottleneck in some of the critical war production programs. Backlogs on Dec. 31 included $200 million of rated orders, to which will be added some $300 million of tools for expansion of production in military programs in 1945, if recent forecasts materialize. This would more than absorb the total production of the industry for the entire year at its recent output rate, with no room for new direct or indirect military programs.

★ ★ ★

REGULATIONS governing maximum prices of nonferrous castings have been simplified somewhat. This includes elimination of the filing of the so-called customer's forms and reduces the amount of information that must be submitted on the remaining two forms, one of which is required with each application for price adjustment. Another change eliminates the reporting requirement of the "small order exemption provision."

★ ★ ★

Relatively few war contractors appear to have availed themselves of the Joint Army-Navy Termination Regulation, the bible for contractors to be used in the rapid settlement of war contracts. A distribution center has been established at 90 Church street, New York, to distribute this publication together with other printed material pertaining to contract settlement.

★ ★ ★

A FEW figures from the war production record: Between July 1, 1940 and Jan. 1, 1945 we built 246,845 airplanes, 75,204 tanks, 55,252 field artillery weapons, 2,422,099 machine guns, 5,942,385 rifles, 4,130,000 tons of bombs, 2,927,302 tons of ground artillery ammunition, 1091 combatant ships, 4631 maritime ships, 110,945 heavy trucks and 658,523 light-heavy trucks.

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Describes Importance Of Steel Castings

Importance to America of the steel castings industry is effectively portrayed in a 64-page bulletin published recently by the Steel Founders' Society of America, Cleveland. Typical applications of steel castings and steps in their production are described by the liberal use of photographs. Tables giving data on the industry's capacity, production, types of equipment and miscellaneous facts also are included.

Chas. Taylor Sons Co., Cincinnati, has appointed T. H. Palmer, of the Fire Brick Supply Co., 603 Wesley Temple building, Minneapolis, as exclusive representative in Minneapolis, North and South Dakota, and northwestern Wisconsin to distribute its refractories. Warehouse stocks will be maintained in Minneapolis and St. Paul.

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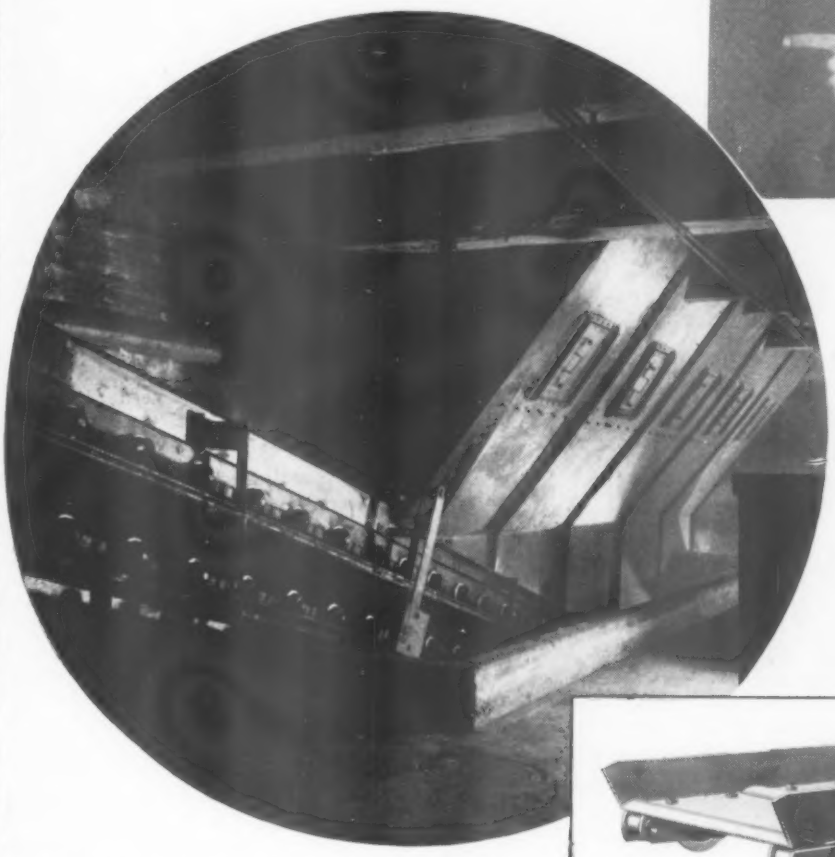
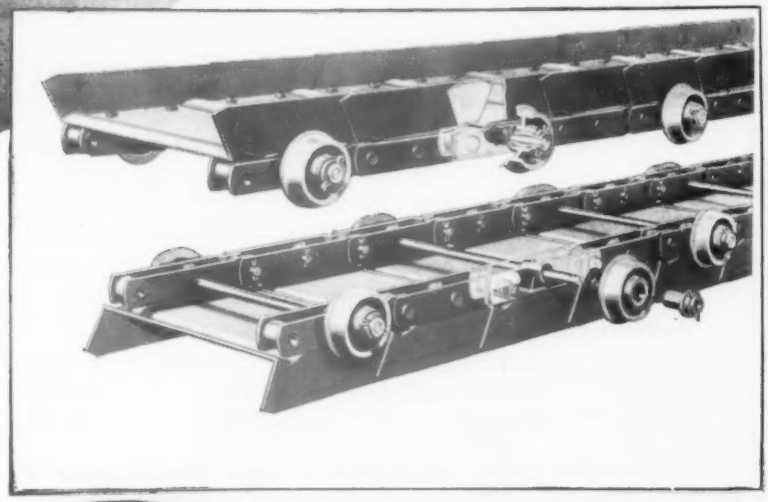
① YOU CAN INCREASE your output without increasing floor space by installing a modern and efficient conveyor system. That's why it will pay you to investigate Rex Foundry Handling Systems that assure a smooth, low-cost "work flow" throughout the entire production cycle.



② FOR EXAMPLE, here, in the world's largest valve manufacturing plant, *each* operation is handled faster and easier because the entire Rex Foundry System was installed to meet the specific problems of the foundry. Picture shows part of the system where a Rex Outboard, Leak-Proof, Apron Conveyor is receiving sand from the shakeouts above, and returning it to the conditioning unit.



③ LEAKAGE and spillage are virtually eliminated with these specially designed heavy-duty steel aprons. A cut-away view of the Rex Leak-Proof Apron Conveyor illustrates the equalizing saddle and outboard roller construction. Note how the carrying load is applied only at the center line of each chain to avoid eccentric loads. Note also, the welded pan, designed for fine, free-running materials that have a tendency to leak through the ordinary pan construction.

The Rex staff of factory-trained engineers are always at your service—to help you design and install the best "work-flow" plan possible. Write for complete information, including Bulletin No. 370. Chain Belt Company, 1671 W. Bruce Street, Milwaukee 4, Wisconsin.

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CHAIN BELT COMPANY OF MILWAUKEE

Rex Chain Belt and Transmission Division, Rex Conveyor and Process Equipment Division, Milwaukee 4, Wisconsin • Baldwin-Duckworth Division, Springfield 2, Massachusetts

BORON IN MALLEABLE IRON

(*Continued from page* 107)

led to consideration of reducing the annealing time, and investigations of many casts of boron-treated malleable iron confirmed the possibility. As various improvements have been carried out, both in the laboratory and in the plants, it has become more evident that annealing time might be reduced. The reduction obtainable is not a constant, but varies from plant to plant and is dependent on the factors previously mentioned. However, a cycle can be worked out for practically every case. Returns play an important part in figuring boron additions because undoubtedly some residual boron will occur on remelt.

One of the strange paradoxes of malleable iron is that the same analysis may be produced by different methods of melting but the physical characteristics of the finished malleable iron may be quite dissimilar. Those who have recently gone to duplexing—for example, from cupola to air furnace or cupola to electric furnace—have found in a number of cases that their iron no longer annealed the same way that it did when the material was made by direct melting. The annealing equipment seemed unable to handle the production and the plant was soon crowded with unannealed castings. Usually 0.001 per cent boron was found insufficient to give much help and records show that in at least one case a plant used as much as 0.005 per cent boron. Just as soon as returns containing boron began coming into the circuit, however, that company was able to reduce the boron to 0.002 per cent total. This transition took about three weeks. Some metallurgists, because of increased melting capacity, found that they had to cut their cycle in annealing, and here again experimental work had to be performed to incorporate the necessary amount of boron to give them the desired cycle.

Accuracy determination is one of the most important points in connection with the use of boron. Some chemists who start analyzing for boron encounter difficulty in obtaining accurate results. This is caused by unfamiliarity with the several proper analytical methods. Many thousands of analyses of boron made by steel plant chemists who check their results give proof of the accuracy of the methods employed.

Several Methods Available

The quinilizarin method, developed by Rudolph and Flickinger of the Youngstown Sheet & Tube Co., may be adapted to malleable iron. Likewise, the tumeric method, developed by the Bureau of Standards, is satisfactory. Through research work of J. A. Berger of the Molybdenum corporation, a spectographic method has been found accurate for check purposes, and many users of boron send in test pins to that company for checking. A boron standard is available at the Bureau of Standards, so that a complete setup for proper control, through analysis, now is possible and uniform results may be expected.

In summary and conclusion, the following points should be observed:

1. Develop proper boron analysis control.
2. Standardize the scrap as much as possible.
3. Make the ferroboron addition to suit the melting conditions.
4. The first use of ferroboron is as a counter-agent against chrome.
5. Reduction of annealing time is possible in both the upper temperature cycle and the lower temperature cycle. How much this will be depends on conditions peculiar to your plant and can be determined only by experiment.

American Machine & Metals Inc., East Moline, Ill., has been awarded a new four-star Army-Navy "E" flag, in recognition of more than 3 years of sustained high production of war implements. The original flag was won in 1942.

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New or improved ferro-alloy products are under continuous development and test—both in the laboratory and in production. Research by the Ohio Ferro-Alloys has always been a growing activity and every new research gives rise to new lines for development. Improvements result that benefit the industry as a whole.

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Canton, Ohio

Chicago Detroit Pittsburgh San Francisco Tacoma

PROPERTIES OF REFRACTORIES

(*Continued from page* 114)

rior to those of the burned brick. The tendency at present is strongly in favor of this process. As indicated by the name, metal case, the third type is that in which a steel case, or sometimes only a steel plate, has been attached firmly to the raw materials in the forming process. The steel will soften at high temperatures, and allow for thermal expansion, as well as weld together the brick on the hot surface. At the same time, the steel adds strength to the structure.

In selecting refractories, it becomes a question of determining the destructive influences which have the greatest importance in the particular application, and choosing the refractory which will best resist them, taking into consideration first cost, as well as ultimate cost. This would be comparatively simple if the destructive factors occurred singly, but, unfortunately, they hardly ever do. Usually it will be found that the choice of a refractory almost always is a compromise because simultaneous conditions require conflicting properties.

One of the outstanding examples of compromise is the use of silica brick in basic open hearth furnace roofs. Conditions in the basic open hearth furnaces are a combination of high temperatures and basic slagging. However, the outside consideration of rigidity enters the picture because sprung arch construction is used. Silica brick are not particularly refractory nor resistant to basic slag, but they do have the ability to withstand high pressure without deforming almost up to their fusion point, and they do not shrink at high temperatures—two properties which are essential to the sprung arch construction. Basic brick have melting points as much as 500 degrees Fahr. above silica. They are resistant to basic slags, and their use would, in many ways, facilitate the operation of the open hearth furnace, but they lack strength at temperatures above 2550 degrees Fahr. Only recently have we reached the point where it would appear that chrome-magnesite brick chemically bonded, and used with a suspended construction, has been perfected sufficiently to make it economical to pay the much higher first cost to arrive at an ultimate saving.

Another example of severe conditions and the necessity for using a refractory which does not fulfill all the requirements is the cupola. Abrasion, melting, slagging, and structural spalling all combine to create almost impossible conditions.

Subject To Spalling

Along with slagging as a destructive force, spalling is one of the most common causes of failure in refractories. It will be noted that three kinds of spalling may occur, namely mechanical, structural, and thermal. Mechanical spalling frequently is caused by pinching due to insufficient allowance for thermal expansion, and the cause is often confused with thermal spalling because the effect on the brick is very similar. Both types of spalling are connected closely with the thermal expansion properties of the brick. The greater the thermal expansion, the more likelihood of pinching, and the greater the influence of temperature fluctuations. Fireclay brick have low thermal expansion, particularly the superduty type of fireclay brick which have a maximum thermal expansion of about 0.7 per cent or about 5/64-inch per foot. This compares with about 1.33 per cent or 5/32-inch per foot for silica, and with 2 per cent or 15/64-inch per foot for chrome and magnesite. At 2500 degrees Fahr., it can be said roughly that thermal expansion of silica brick is twice that of superduty fireclay brick, and the thermal expansion of chrome and magnesite brick is three times that of superduty fireclay.

Structural spalling is that which occurs when changes take place in the texture of the brick. One such change is known as vitrification, and may be due to high temperatures or to absorption of fluxes into the brick. These changes

(*Continued on page* 226)

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THEY SAY:

"On seven shakeouts and in the cleaning-room, where the belt encounters sprues and gaggers, SAHARA consistently has given 100% longer service than competitive belts."

"In a test of several leading brands of hot material belts on our shakeout conveyor, SAHARA outperformed all competition by two to one."

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THE WHEELS OF INDUSTRY

(Continued from page 224)

may alter the coefficient of expansion and cause the exposed end of the brick to crack off. Frequently such cracking will occur when a furnace is cooled off after having been in operation for some time. The cracks may not be noticeable while the furnace is cool but when it is heated up again the whole face of a wall may come off. Even though it resembles temperature spalling, this would be typical structural spalling.

The table shows the approximate porosity of the various brick. This property, or its opposite—density—has an important influence on the resistance of the brick to slag action. Thus, one of the chief advantages of the stiff mud fireclay brick is low porosity, and one of the chief disadvantages of the diaspore type of high alumina brick is the high porosity. Slag penetrates easier into a porous brick, and the heat conductivity of a brick with high porosity is lower, which again means higher hot surface temperature and more severe slagging action. Low porosity also usually is combined with greater structural strength, which, in itself, improves resistance to slag action.

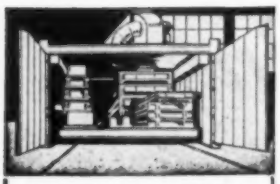
One type of refractory about which little has been mentioned is the kyanite-sillimanite-mullite type. This falls in chemical composition within the high alumina refractories, but ordinarily only refractories made from diaspore are included in this classification. The raw material for the mullite brick is India kyanite, sometimes mixed with domestic kyanite, which explains the great difference in cost between the 60 per cent alumina diaspore brick and the kyanite brick which have very similar chemical compositions. The properties of a good kyanite brick are very desirable. It is more refractory than fireclay and silica brick. It has good cold strength and excellent hot strength up to almost the same point as silica. It has low thermal expansion and little tendency to vitrify so that it is almost non-spalling. Chemically, it is almost neutral, and therefore it is quite slag resistant. If it could be produced at anywhere near the cost of fireclay and silica brick, it would certainly replace these for most applications, but with the present high cost, its applications necessarily are limited, although steadily growing.

Heat Conservation Desirable

One function of a refractory material which has not been mentioned is that of confinement of heat. In most applications it is desirable that a refractory should have low heat conductivity so that it will retain the heat where it is serving a useful purpose. There are exceptions to this, such as refractory muffles, recuperators, and coke oven chambers where heat is applied through the refractory. There are other exceptions where the confinement of heat would increase the balance of chemical reactions and cause unduly rapid wear, such as cupolas, air furnaces, glass melting furnaces, and others where the saving of heat would be outweighed by the loss in refractories. Where the conditions will permit conservation of heat, it is of course, desirable.

Ultimate in heat conservation through low heat conductivity can be accomplished by combining refractory properties with insulating properties. This is being done in the manufacture of insulating firebrick. Insulating firebrick are actually fireclay or kyanite brick with abnormally high porosity. The high porosity is obtained by mixing a combustible material with the refractory raw materials. The combustible material burns away in the burning process, leaving voids which materially reduce the heat conductivity. Since we have stressed repeatedly the desirability of density in refractories, it is obvious that insulating fire brick only can be exposed to furnace conditions where there is no slagging or abrasion. However, they can often be used to advantage to back up standard refractories if these are of sufficient quality to withstand the greater severity of the conditions to which they will be exposed when they are insulated. Without a doubt, one of the reasons for the continuously increasing demand for better refractories is to be found in more extensive use of insulation which frequently will consist of a layer of insulating fire brick followed by a backing

(Concluded on page 228)



Sturtevant Core Oven Fans

That's right, mister — it doesn't need any. You're looking at a Sturtevant Planovane Fan — equipped with a small extra fan that cools the shaft bearings more surely than water. This "heat slinger" is mounted on the main shaft . . . pulls enough heat away from it to keep temperatures safely below 200°F., yet doesn't cost a dime to operate. There's round-the-clock production, less danger of slow-up due to overheating when you specify Planovanes.

An especially valuable feature of this fan—its unimpaired efficiency when handling dirty air — makes it especially suitable for core ovens, mold drying and heat treating. And here's what else it offers:

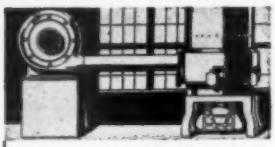
1. Dependable, continuous service
2. Smooth air flow
3. Low Power Costs
4. Slower operating speeds

Special wheels are available for handling explosive gases or corrosive materials. Write for engineering cooperation and performance data.

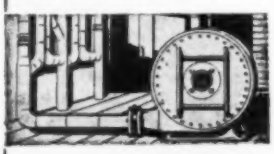
B. F. STURTEVANT COMPANY
Hyde Park Boston 36, Mass.

Sturtevant
Puts Air to Work

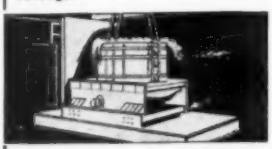
OTHER STURTEVANT PRODUCTS *tailor-made* FOR YOUR INDUSTRY



Sturtevant Cupola Blowers—assure smooth, constant pressure supply of air. Compact, simple sturdy construction; sizes and types for all conditions.



Sturtevant Compressors—hold air pressure constant, in supplying blast to oil or coke burners. Lifetime efficiency, minimum maintenance; worthwhile power savings.

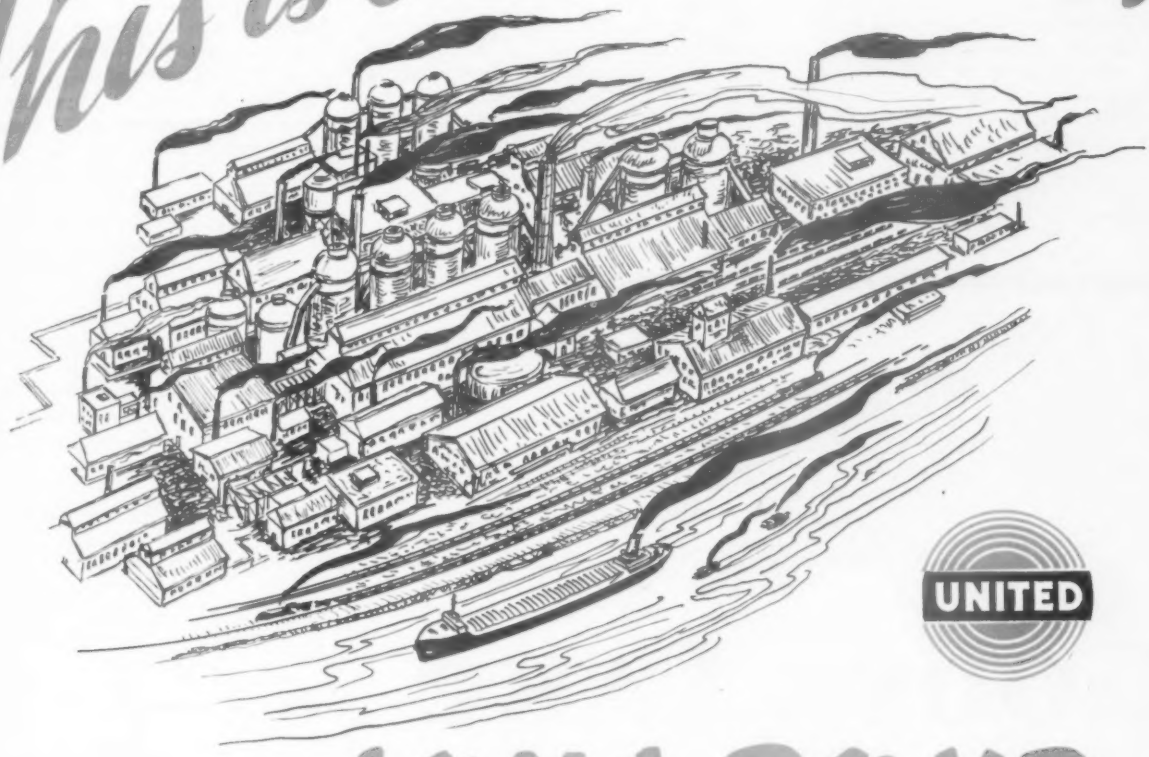


Sturtevant Foundry Shake-out Systems—effectively control dust and fumes, increase worker efficiency and equipment life, cut down maintenance.

Sturtevant Dust Control—pioneer experience in engineered systems for collecting dust from snagging, tumbling and sand-blasting operations.

Sturtevant Fume Control—efficient tailor-made systems for production foundries or low-operating-cost equipment for jobbing shops.

This is our Answer!



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AQUA-BOND No. 310 liquid core binder is our answer to the call of industry for speeded up production of vital materials. Leading foundries, working to exacting specifications, have discovered this emulsified type of oil to be of enormous value in the speedy production of strong, open and well vented cores. AQUA-BOND No. 310 bakes out faster, gives off less gas on pouring and burns out faster with metal heat. AQUA-BOND No. 310 is the answer to your present and post-war core problems. It is clean to work with, sets up faster and will protect the finest of work in all types of metals. Why not write today for full information regarding this excellent liquid core binder, contained in the bulletin we have prepared for you?

United OIL MFG. CO.

1429 WALNUT ST., ERIE, PA.

(*Concluded from page 226*)

layer of insulating material to prevent further heat losses.

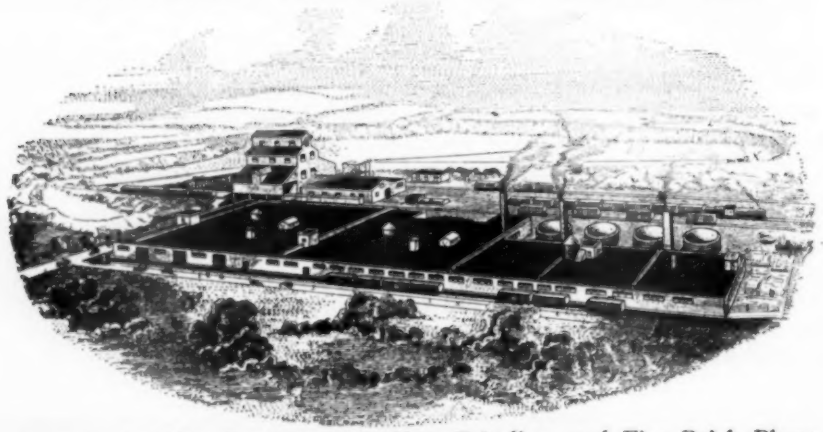
Another class of refractory materials which is becoming increasingly popular for many applications is refractory ramming mixes. Ramming mixes are produced in all the classifications of refractories considered previously. Plastic fire brick corresponding to high heat duty firebrick is being used widely for patching and for furnace sections which would require the use of special shapes. Super plastic, corresponding to high alumina brick, has many of the desirable features of the brick, and the added advantage of flexibility. Silica ramming mixtures are becoming increasingly useful as ladle linings and as linings for furnaces with acid slags. Kyanite ramming mixes are being used in nonferrous melting furnaces. Magnesite ramming mixes are gaining popularity for open hearth and electric furnace bottoms. Plastic chrome is, in increasing quantities, being used to cover studded tubes in water wall boilers, as well as in metallurgical applications.

The refractories manufacturers have realized the usefulness of a refractory which can be rammed in place where it is going to be used, and which can be used without joints, without bonding mortars, and giving a perfect fit. Therefore, special care is now being given to the manufacture of ramming mixes. Selected raw materials, careful grain sizing, prolonged tempering, and packing in containers particularly suited for the purpose is now standard procedure. In many cases, not only explicit instructions for application, but actual help in supervising installations, will be furnished. Since the ramming mixes have to be formed, dried, and burned with sufficient care to give at least comparable service to pre-formed refractories, it will be realized that the process of installation is quite as important as the process of manufacture. Carefully applied, slowly dried, and slowly burned-in before use, a ramming mix will often out-perform pre-formed refractories.

The success of ramming mixes must be attributed, in part, to the elimination of joints. This brings attention again to the importance of using jointing materials of at least as good quality as the refractories with which they are used. Many furnaces fail prematurely because the joints are unable to withstand slagging action as well as the surrounding brick, and many plants are still using the cheapest grade of fireclay to bond good refractories. However, the manufacturers of refractories have been doing excellent work in the last decade, not only in developing much better bonding materials, but also in educating the users in the proper application of them.

GOOSE LAKE

Fire Clay and
Fire Clay Flour
Fire Clay Brick
Therm-O-Flake Insulation



Goose Lake Clay Deposit with Clay Grinding and Fire Brick Plant

Illinois Clay Products Company

JOLIET, ILL.

Manganese Bronze Propellers

(*Continued from page 109*)

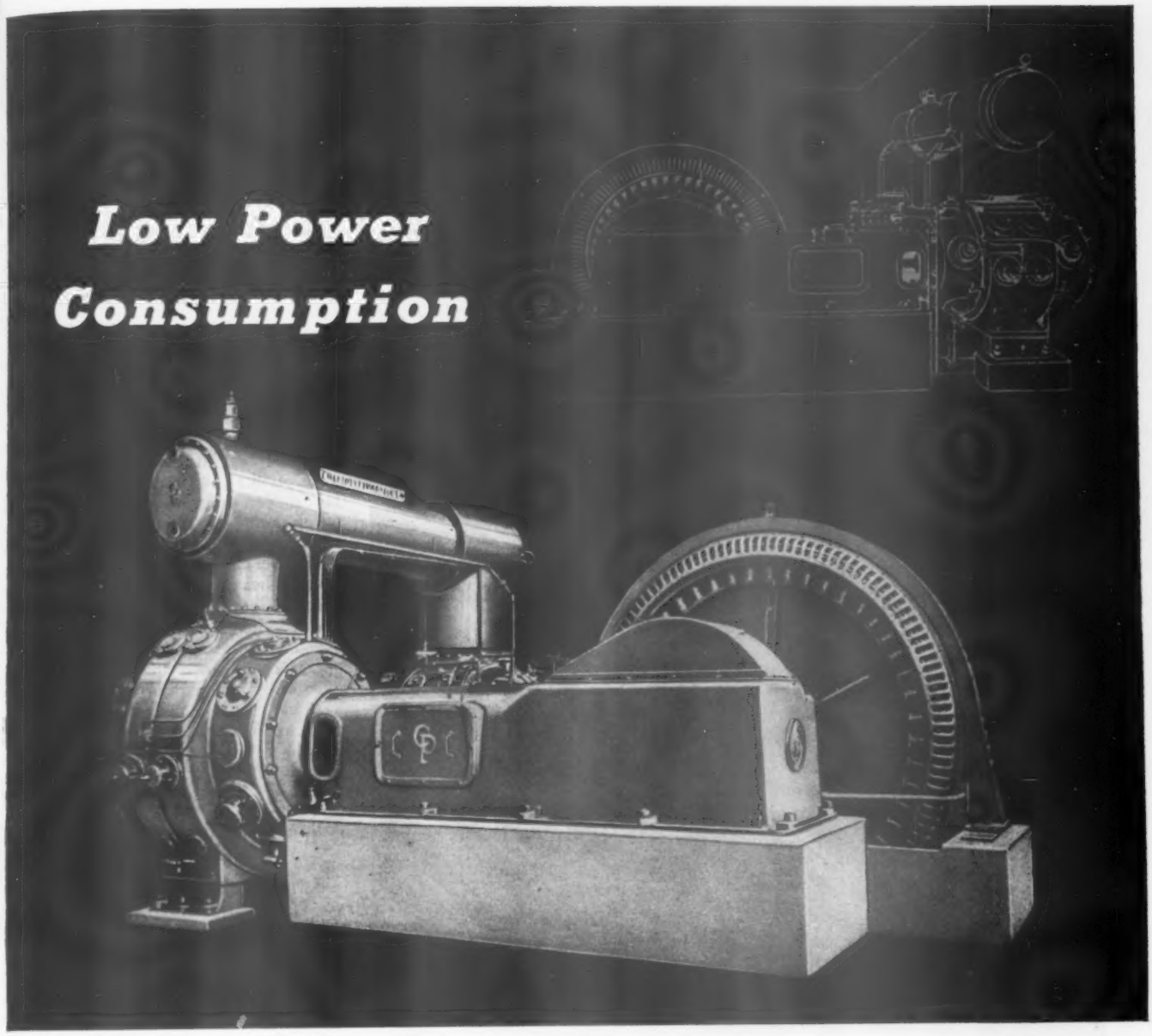
70,000 pounds per square inch, and 35 per cent elongation.

Fig. 3—Metal is poured into a large basin erected outside and close to the mold. A plug is lifted when the basin is filled to permit clean metal to enter a vertical sprue made up of tiles. At a certain distance down, the sprue changes to a horizontal direction and delivers metal to the bottom of the hub in the casting.

Operators pouring the metal keep the basin filled until the metal appears in the bottom of the risers or sinkhead. The remainder of the sinkhead is filled later with hot metal from an auxiliary ladle and covered with charcoal or other insulating material. Even under the most favorable conditions, manganese bronze develops a certain amount of dross. To prevent this dross from entering the blade cavities, four men stand above the open sinkhead and manipulate long handle skimmers to keep the dross in the center where eventually it floats to the top and is no longer a menace. Even though the center core projects through the sinkhead, the weight of this extra metal amounts to quite an item, 6000 pounds for the Liberty ship and 11,000 pounds for the Victory ship type propeller.

Fig. 4—After the casting is shaken out it is mounted in a device where the sink-

(*Concluded on page 230*)



BUILT INTO CP CLASS O-CE COMPRESSOR

THE low power consumption of the heavy-duty Chicago Pneumatic Class O-CE Compressor is the result of large area, durable, quick-acting Simplate valves . . . streamlined air passages . . . multi-step capacity regulation . . . thoroughly effective intercooling and water jacketing and efficient lubrication.

CP Class O-CE Compressor is of the horizontal, double-acting, water-cooled type with direct-mounted synchronous motor drive. Capacities range from 350 c.f.m. to 10,000 c.f.m., 80 pounds to 125 pounds pressure. Other sizes available for lower and higher pressures and for other types of drive. Write for Bulletin 726.

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PNEUMATIC TOOLS
ELECTRIC TOOLS
HYDRAULIC TOOLS
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

(Concluded from page 228)
head is removed with a circular saw.

In the machine and finishing shops the hub is faced on both sides and bored to fit the tapered end of the shaft. Keyways are cut and a hole is tapped and threaded at one side for the introduction of tallow filling. Stud bolts are inserted in the outer face for attaching a tapered cap. Edges of the blades cast to an approximate thickness of 1 inch are chipped and ground down to a feather edge. The entire face of each blade is machined on a special profiling machine in which the cutting tool is guided by a delicate finger moving over a stationary model.

After the entire face has been machined to exacting specifications of gage and instrument, the face is ground and polished. Then the wheel is mounted and revolved in a balancing device operating so accurately that the slightest difference in weight between any of the blades readily is detected. Whenever and wherever necessary the extra metal is removed until the wheel is in absolute balance.

Waukesha Foundry Co., Waukesha, Wis., has been awarded the third star for its Army-Navy "E" pennant, in recognition of continued outstanding war production.

SMOOTH, CLEAN
CHILL NAILS
ASSURE
SOUND
CASTINGS
CAPEWELL
HACK SAW BLADES
Cut Costs and
Cut Time . . .
Improved heat treating is responsible for the faster cutting and longer life of Capewell hack saw blades. Hence the saving in production time and costs. Prove these advantages with your own tests.
Capewell foundry chill nails are smooth, clean and bright — because they are cold rolled from the finest soft iron. They fuse readily. The Capewell line — the most complete — has the right nail for your job. Send for samples.
THE CAPEWELL MFG. CO.
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MOLYBDENUM
TECHNITE
HIGH SPEED
CAPEWELL
CHILL NAILS • HACK SAW BLADES

PLANNING THE FOUNDRY OF TOMORROW

(Continued from page 99)

In this case we will use hydraulic pushers to do the heavy work so that one person of ordinary strength by turning a valve can push the correct amount of metal into the hopper and charge a cupola.

At the lower end of the track just outside the metal yard the charge will be dropped into a charging bucket which will be automatically conveyed to the cupola door and charged. This will be done by skip hoist, crane, or other type of conveyor. At the last station of the scale car the coke and limestone will also be dropped from overhead bins into the weigh hopper. Thus while one charge is being put into the cupola the next is being weighed. By this means we can save a heavy expensive charging floor and need only a light platform at the doors. The crane runway will be roofed over above the weighing bins so that the operators, the mechanism and the metal will be protected from the weather.

Above each charging system will be two coke bins and a limestone bin, each holding at least a carload. We have already referred to the loading of these bins. Air operated gates will facilitate quick and easy opening and closing.

Cupolas in Separate Wing

As indicated by the sketch the cupolas are located in a wing at the far end of the foundry. This is for the purpose of comfort and cleanliness and will add but a few seconds to the time from tapping to pouring. By putting the cupolas in a narrow building the heat and dust can be controlled and directed by the ventilating system away from the molding department. There will be fresh air on two sides. The cupolas will be mounted on a concrete platform a short distance above the floor, with a brick wall reaching to the bottom plate level along the front side and past the ends. This platform will slope slightly to the rear to shed water and facilitate handling the drop instead of letting it spread in every direction with no definite boundary for cleanness.

The cupola bottoms and spouts should be high enough to permit the use of receiving ladles and also let the conveyor troughs, which disintegrate and remove the slag, to pass overhead. In front of the cupolas will be the receiving ladles and the hot metal carrier tracks and also the pig beds. Consideration will be given to space for housing dry blast and hot blast equipment overhead, also the blowers with the proper instruments for gaging and regulating the blast. At the extreme right of this building will be an extension out to the track for unloading and storing brick. At the lower end will be a room for lining and drying the

(Continued on page 232)

THIS WHEEL ADDS 48 MINUTES TO AN 8 HOUR SHIFT

Electro **Grinding Wheels make a 10% gain in cutting time with plant to plant regularity as they are adopted as standard. Greater gains often are reported.**

The reasons are two: (1) the structures developed make ELECTRO Grinding Wheels cut faster; and (2) the type of abrasive grain used is selected for fast cutting while retaining durability.

These two factors enable the operators to reach a higher unit hours of production.

ELECTRO Engineers are ready to present proof in your plant as well as to help accomplish both volume and quality gains on your production. Just phone Buffalo, N. Y., WAshington 5259...or, write or wire.

Tougher and more Durable

RUGGEDLY CONSTRUCTED and HEAT RESISTANT

Electro-REFRACTORIES & ALLOYS CORPORATION

MFRS. • CRUCIBLES • REFRACTORIES • STOPPERS • ALLOYS • GRINDING WHEELS

344 DELAWARE AVENUE — *Established 1919* — BUFFALO 2, NEW YORK

(*Continued from page 230*)

ladles. If more cupolas are needed the building can be extended to the right.

Height of the charging door above the bottom should be sufficient for preheating the charge. For this foundry it will be about 24 feet. Above the charging door the cupola stack should extend high enough for complete combustion of the gas before it reaches the top, and on the top should be placed some form of dust and spark eliminator. There are several kinds in use which, by increasing the areas, reduce the velocity of the gases and change their direction, causing the dust to drop. This is aided by a water spray which washes out the dust, cools the gas and finally acts as a carrier for sluicing the dust away to a sump for final disposal. The water can be used over again. Tests have shown that 24 pounds of dust may be given off in melting a ton of metal. This, of course, would vary with the charge and the blast. Such equipment will pay for itself in cleanness of roofs, metal yard, and windows as well as the general cleanness of the foundry and neighborhood.

Ventilation—Frequently men do not want to work in a foundry because of the working conditions. In this foundry we can make most of the conditions as desirable as elsewhere. Our conventional foundry has a high ceiling with ventilation in the roof. We let nature take the heat and dust upward where it cools and spreads the dust over everything, then we set up local ventilation stations that fight against the overhead ventilation and succeed in removing a considerable amount of heat and dirt. The remainder is recirculated through the building.

In this foundry we will not use the high ceiling and natural ventilation but will make a low flat ceiling and, admitting the fresh air from above at about ½-inch pressure, will suck it toward the few points where dust and heat are bad. If the air travels in one direction the heat and dust will not travel against it. The height of this ceiling will be just sufficient to clear the light cranes and monorails, probably about 12 feet. Scientifically placed light fixtures will give uniform illumination, without shadows, day and night. There will be no overhead windows to keep clean. (This plan would not be satisfactory for a heavy jobbing foundry.)

Sources of Heat and Dirt

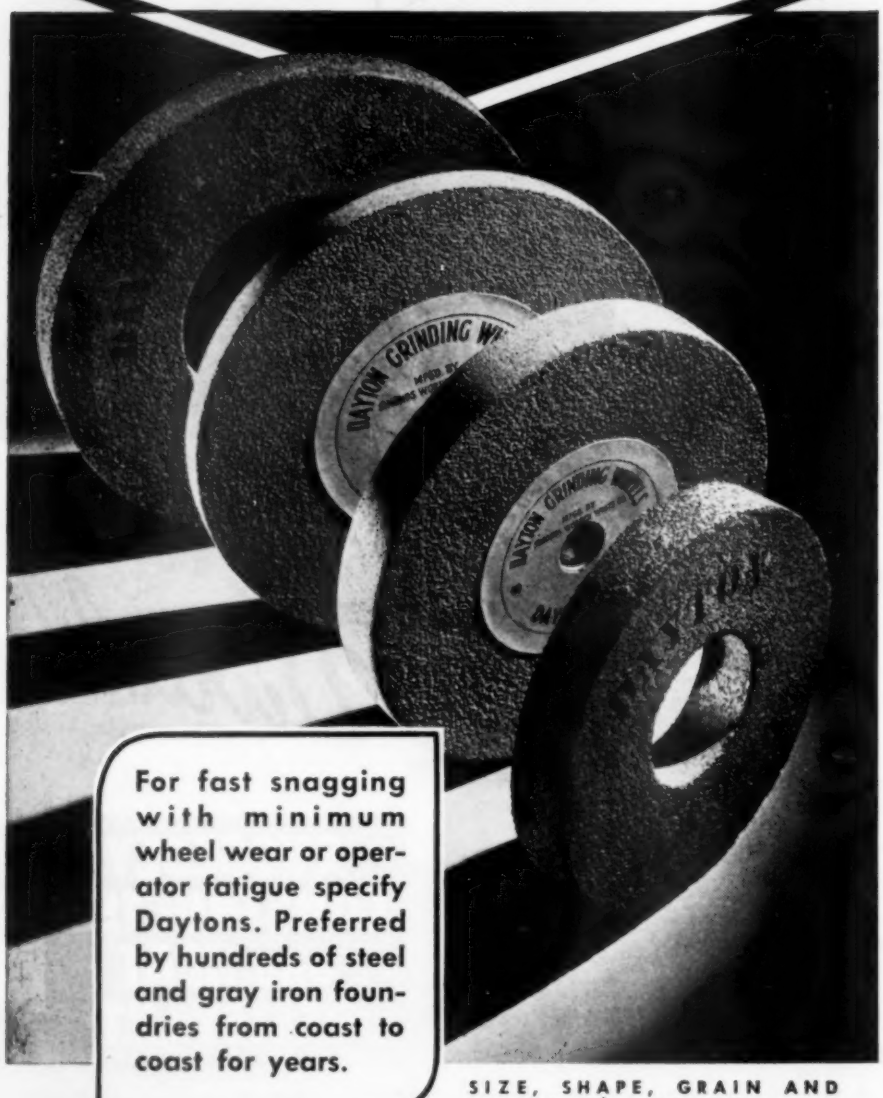
In this type of foundry there are two main sources of heat and dirt—the pouring zones and the shakeout stations. We will have all the pouring stations in one line at the upper end, and the shakeout stations we will put in ventilated tunnel basements to be described later. As we will have sectional exhaust ventilation across the mold conveyors from where we pour, most of the air from the foundry will flow toward these sections and the heat and smoke will not go back to the molders or even to the pourers. As the ceiling is low there is little stack effect to pull the dust upward and as the cubic volume is small, less air will be required to be blown in and less to be exhausted. The sand distribution system will be in a loft above the foundry ceiling, taking it from a mulling station just outside the molding building.

Mold Conveyors—Mold conveyors will be laid out in the usual loop form but to the casual visitor they will look like straight line conveyors, since the turns and the mold cooling side of the loops will be in tunnels beneath the floor. This arrangement permits serving the conveyor from either side and eliminates the enclosed pocket inside where dirt and rubbish collect. There are no cooling hoods above the floor and one can see across the foundry without obstruction, which is a help to supervision. Height of the mold conveyor past the drag machines will be the proper height for receiving the drag flasks; at the core setting section it will be lower so that workmen standing on the floor can set the cores and close the flask. At the pouring section the conveyor will be floor height so it will not be necessary to raise the pouring conveyor above the floor.

Tunnels through which the cooling side of the conveyor will pass will be wide enough for two cooling conveyors, one on each side; also the strike off sand conveyors under two molding lines.

(*Continued on page 234*)

DAYTON
SNAGGING WHEELS

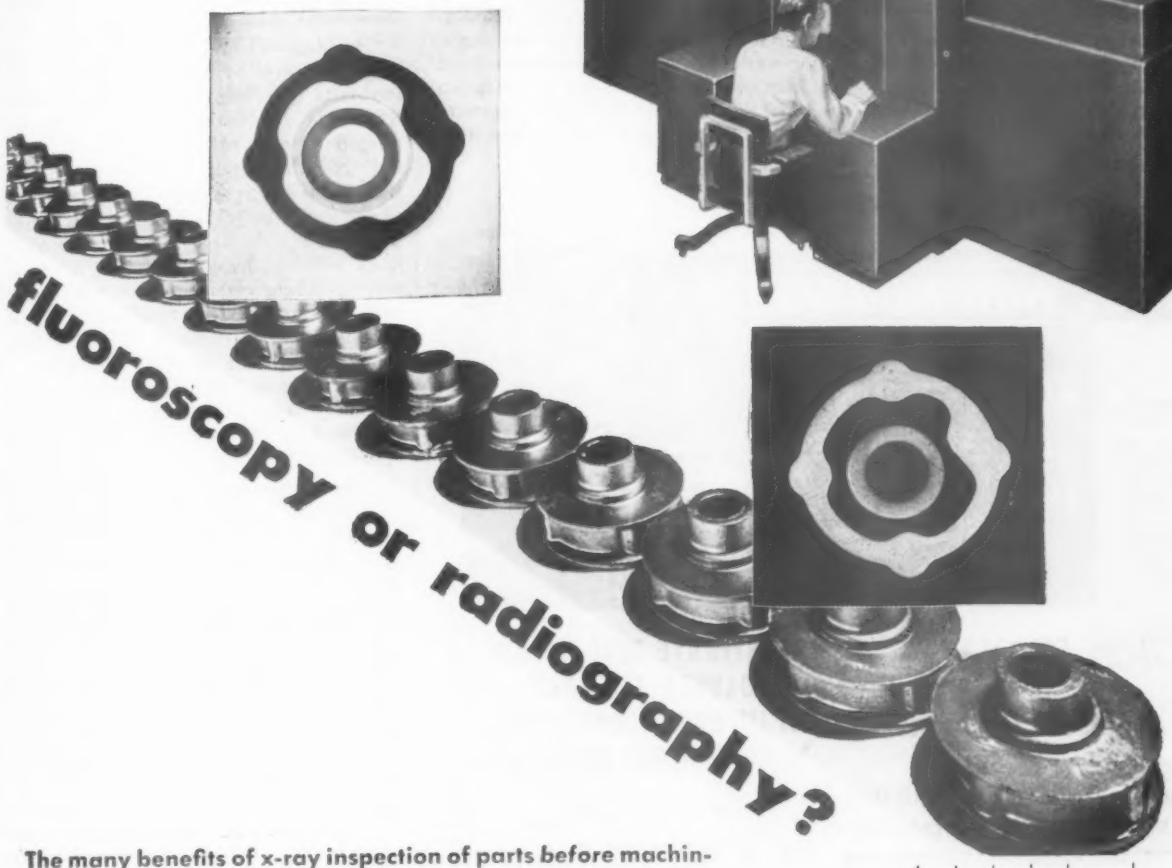


For fast snagging with minimum wheel wear or operator fatigue specify Daytons. Preferred by hundreds of steel and gray iron foundries from coast to coast for years.

SIZE, SHAPE, GRAIN AND GRADE REQUIRED.
WRITE, PHONE OR WIRE.

SIMONDS WORDEN WHITE CO.
710 NEGLEY PLACE, DAYTON 7, OHIO

The inspector is seated comfortably before the fluoroscopic window of the Picker Ray-Proof Combination X-Ray Inspection Unit. The Unit requires no manual unloading, since ejection of defective parts is automatic.



fluoroscopy or radiography?

The many benefits of x-ray inspection of parts *before* machining have been amply demonstrated in hundreds of case histories where lower costs and higher quality are the end results. The question then resolves itself in one of *method*. Within its limitations, x-ray fluoroscopy is the ideal answer in some cases; radiography is indicated in others. The determining factors are density and section thickness of the material to be examined.

This Picker Combination Conveyor Production Inspection Unit is designed to perform both fluoroscopy and radiography with equal facility. This single Combination Unit obviates the previous need for a separate apparatus for either function.

A Picker engineer will be glad to survey your own inspection problems and recommend a practical procedure, based on your individual requirements. The Picker line of industrial x-ray inspection units embraces types designed not only for large quantity production inspection requirements, but also for small-scale examination where major investment is neither necessary or desirable.

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We are interested in the inspection of: _____

_____ Alloy _____ Quantity per hour

Maximum Section Thickness _____

Other Particulars _____

NAME _____

COMPANY _____

CITY _____ STATE _____

(This coupon can only cover the highlights of your inspection problem. If you wish to describe it more fully in a letter, it will help us in preparing a recommendation.)

(*Continued from page 232*)

These will be covered by hoods with their own ventilation. The tunnels will probably be about 8 feet high, 30 feet wide and lined with smooth light-colored brick. Fresh air will be blown in at the ends and exhausted at the shakeout station on the opposite side from the operator. Thus cool fresh air will flow through the tunnels toward the shakeout section, passing the men before it picks up the dust and steam.

With this arrangement the tunnel will be as cool and clean as any part of the foundry and the shakeout operation, mechanically operated, will not be a hot dirty job. Smaller castings will drop on to a vibrating screen and pass on to an apron conveyor which will take them outside the foundry ready to be loaded in baskets on the overhead cooling conveyor. This will not require manual labor. Cylinder blocks will be lifted out and hung on a cooling conveyor also outside the foundry. This job may be warm but proper directioning of air will reduce the heat and dirt.

Another advantage of this low ceiling foundry will be the low cost of heating. All the air that is removed in the ventilating system will be washed and have the dust removed. In some cases it can be returned through the heating system, or the heat in it used to modify the temperature of the clean incoming air. At any rate, the atmosphere around the foundry will not be contaminated by foundry dust and the roofs covered with it. The silicosis hazard will be eliminated.

Flasks in general will be large to accommodate more castings to a set, but roll offs and hoists will be used so that the heavy work and lifting will be reduced and a lighter man can produce more work with less exertion.

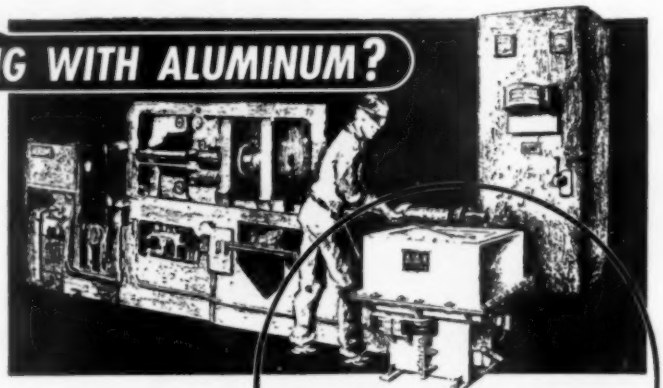
Cleaning—From the foundry the castings will travel by overhead cooling conveyors to the cleaning department at the left. The conveyors' length will be arranged to give sufficient time for cooling, but the return section will be as short as possible so that the greater part of the chain length will be in active use. The castings from the various molding lines will be delivered at the heads of corresponding cleaning lines where they will be shot blasted, tumbled, chipped, ground, etc., as required. There will be numerous special grinding machines to grind the faces of various castings automatically such as grinding the top and bottom face of a cylinder block at one operation.

Core Department — Along the lower side of our group of buildings we will place the sand storage, sand reclaiming, sand mixing and the core department. Below this is the track for bringing in the sand, core binders and core wire. A craneway from the sand storage section will extend over the track, and below will be a hopper for unloading hopper bottom cars. The sand will be stored, then dried, cooled and mixed before using. Core sand from the shakeout and knockout will be returned to this section for wet scrubbing and classification, then dried, cooled and mixed the same as the new sand. By sand reclamation less sand storage will be required, less sand purchased and less disposed of as refuse.

In the sand mixing department the sand and other ingredients will be fed into weigh hoppers and automatically weighed by an electric eye on the scale dial. Fluids will be metered into the mixers in the same way. Various mixtures of core sand will be put in temporary storage bins and from these it will be taken in bottom dump hoppers by monorail along a gallery at the lower side of the building to hoppers above the core making stations below.

The vertical core ovens will be placed in a row extending the length of the building and about 30 feet from the wall. Because of the difference in size of cores and also variations in schedule, vertical ovens seem the most flexible for this purpose. There will be one high section of the building to house the upper part of these ovens. No heat or fumes should be present near the floor. When the cores are removed from the ovens the plates or dryers will be returned directly to the core makers, only a short distance away, while the cores are processed as they pass across the building. They will be stored on racks at the side of the building nearest the foundry,

WORKING WITH ALUMINUM?



Typical layout for die casting, showing compact 20 KW Ajax-Tama-Wyatt furnace in position. Unit comes with complete control cubicle, as shown.

INVESTIGATE THIS UNIQUE HOLDING FURNACE for IMPROVED OPERATIONS and LOWERED COSTS!

INDUCTION FURNACES MEAN A MODERN PLANT..

In addition to the holding furnace here described, small, compact, twin-coil melting furnaces are likewise available for continuous production.

Rolling mills and foundries using Ajax-Tama-Wyatt units have *consistently* developed the highest physical properties in their aluminum products . . . with decreased gas absorption, absence of all segregation, and elimination of oxide inclusions and hard spots . . .

Clean-cut temperature control, great ease and simplicity of handling are operating characteristics. Ajax induction furnaces give you a modern plant, a cooler foundry, a better product. Significantly, too, they have been known to pay for themselves within less than six months. *Write for latest TW catalogs describing both Ajax holding and melting furnaces for aluminum!*

ADVANTAGES

- Every element of uncertainty is removed from holding furnace procedure
- Automatic, positive temperature control to within 5 degrees
- No segregation, iron pickup, or contamination — automatic stirring
- Always ready to operate — no heating up or waiting periods
- Pays for itself quickly by doing away with pot or crucible replacements
- Maintenance costs so low as to be virtually negligible
- Low operating costs — only 12 KW for holding continuously up to 400 lb.; 8 KW when covered on week ends
- Greatly improved overall foundry conditions inherent in induction melting

AJAX TAMA-WYATT INDUCTION MELTING FURNACE

AJAX ENGINEERING CORPORATION • BOX 1418 • TRENTON 7 • N. J.

ASSOCIATE COMPANIES

AJAX METAL COMPANY, Non-Ferrous Ingot Metals and Alloys for Foundry Use
AJAX ELECTROTHERMIC CORP., Ajax-Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax-Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax-Wyatt Induction Furnaces for Melting

ready to be taken in as needed. Covered passageways will be provided for this.

If greater core room capacity is needed the building can be extended to the right, giving room for more core making, more core ovens, and the space for processing and storage.

General—The foundry will also be provided with well equipped laboratories near the cupola building, clean toilet and wash rooms in the various buildings and well ventilated locker rooms. A clean lunch room will also be provided. Along the left side of the cleaning building will be a two-story office building also containing first aid, store rooms, service department, with pattern repair and storage on the second floor. If more cleaning room space is needed this can be used and a new office building added.

All buildings will be connected by covered passageways so that the men need not go out into the weather in passing from one to the other.

Adequate parking lots will also be arranged convenient to the entrance gate.

With proper management this foundry should present as good working conditions as can be found in other manufacturing departments. It will not be necessary to pay a bonus in order to get men to work here.

Electric Furnace Capacity

(*Continued from page* 115)

dimensions on metal slag equilibrium as well as the effect of bath dimensions on other physical and chemical reactions which take place during the refining, are omitted.

The angle which the metal surface makes with the furnace bottom is calculated for three different depth/diameter ratios and we obtain the following results:

Depth/ Diameter Ratio	Angle between metal surface and furnace bottom
1/4	53° 10′
1/5	43° 40′
1/6	36° 50′

Most electric furnaces are built to tilt a maximum of 45 degrees. Many go over only 40 degrees or even 35 degrees, and some especially large ones tilt even less. This means that for a furnace to drain properly, the angle between metal surface and furnace bottom must be less than 45 degrees. On this basis, the maximum depth/diameter ratio for furnace bath is 1/5. This has been found to work out well in the field. A good minimum capacity, which is one-half the recommended maximum capacity, gives a depth/diameter ratio of 1/6 when using the original bottom contour. This has also been found to work out well in practice. Heats smaller than this minimum capacity are difficult to handle in the furnace.

Fig. 1 shows the diagram of a theoretical furnace shell. Note that dimension W refers to depth of brick only and does not include any back-up material. Wall refractories usually remain in service until they are about one-half their original thickness. Maximum shell capacity is figured with one-quarter of the wall brick worn away. This brings the slag line for maximum capacity bath up on the vertical surface of the wall refractories when they are new. This has not been objectionable. When wall refractories are thin, all slag line corrosion occurs on the sloping part of bottom where it is easy to patch.

Fig. 2 is a chart showing diameter of bath with 1/5 depth/diameter ratio for any capacity from 250 pounds to 12,000 pounds. This covers most foundry furnaces. Fig. 3 is a chart showing diameter of bath with 1/5 depth/diameter ratio for capacities from 6 tons to 200 tons. These are mostly steel mill furnaces. Note the curves giving diameter of shell required to hold a given size bath. The curves correspond to various thicknesses of wall refractories with indicated amounts of back-up material. To arrive at theoretical shell diameter, it is assumed that one-fourth of the wall brick are worn away as shown in Fig. 1.

Usually wall thickness is approximately two-thirds of bath depth, and bottom is approximately equal to bath depth. On larger furnaces the amount

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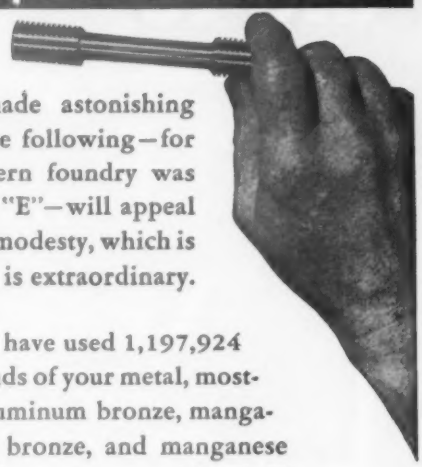
REJECTS BELOW 1/4 OF 1%!
A Highly Expert Foundryman reports to AJAX



Nonferrous founders have made astonishing records in the last 3 years. The following—for which this representative eastern foundry was thrice awarded the Army-Navy "E"—will appeal to all foundrymen because of its modesty, which is typical, though the achievement is extraordinary.

Send for booklet
"INGOT METALS OF TODAY"

16 STANDARD INGOT METALS BY AJAX

Ajax Tombasil
Ajax Plastic Bronze
Ajax Anti-Acid Bronze
Ajax Phosphor Bronze
Ajax Red Brass Ingots
Ajax Manganese Bronze
Ajax High-Tensile Manganese Bronze
Ajax Golden Glow Yellow Brass
Ajax Nickel-Copper 50-50%
Ajax-Hamilton Gear Bronze
Ajax Manganese Copper
Ajax Aluminum Alloys
Ajax Phosphor Copper
Ajax Silicon Copper
Ajax Nickel Alloys
Ajax Phosphor Tin

NOTE

"Proper Melting Decreases Foundry Losses," contains interesting data. Also, the booklet, "Nonferrous Ingot Metals of Today." Write for both of these. They are free.

"We have used 1,197,924 pounds of your metal, mostly aluminum bronze, manganese bronze, and manganese aluminum bronze. All of this has gone into Army and Navy material. It has been subjected to severe tests, both chemical and physical, in castings weighing from ½ to 750 lb. each. A lot of this had to stand a hydrostatic test of 7,700 lb. On this production, we feel it safe to say that our rejects have been less than ¼ of 1% due first, to your fine quality of metal, and second, to our good luck."

We are always gratified to receive letters of this character, and take pleasure in placing it among many similar ones received during our 65 years in the metal business.

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ESTABLISHED 1880 METAL COMPANY · PHILADELPHIA

AJAX ELECTRIC FURNACE CORP., Ajax-Wyatt Induction Furnaces for Melting
AJAX ELECTROTHERMIC CORP., Ajax-Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax-Hultgren Electric Salt Bath Furnace
AJAX ENGINEERING CORP., Ajax-Toma-Wyatt Aluminum Melting Induction Furnaces

ASSOCIATE COMPANIES

of refractories is usually less than these ratios, while on smaller ones it is usually more. Wall thicknesses should correspond to standard brick dimensions.

The following suggested wall thicknesses may be a helpful reference:

Bath Capacity	Thickness of Wall Brick Inches
250 to 1000 pounds	6
1000 to 4000 pounds	9
4000 to 24,000 pounds	13½
12 ton to 100 tons	18
100 ton to 200 tons	22½

With the foregoing data it is a simple procedure to calculate recommended maximum and minimum size heats for any furnace shell. It is also possible to determine the best shell size for a given capacity bath or charge.

This recommended furnace capacity should be interpreted in the same manner as maximum recommended load capacity for a truck or maximum recommended lifting capacity for a crane or hoist. It is entirely possible for an operator to overload his equipment beyond this recommended limit, but this overloading greatly increases maintenance costs and shortens life of the equipment.

Melting rate is quite independent of shell capacity and should not be confused with it; however, this would make a subject for another article.

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HERE'S why Johns-Manville Core Plate changes one-time buyers into long-time customers:

Light Weight: Transite Core Plates light weight means easier handling, increased production.

Less Breakage: Their fibrous nature provides unusual shock resistance, minimizes breaking and cracking.

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Economical: These J-M plates combine low initial price, low handling costs and long life.

Low Warpage: Maximum warpage on plates under 24" is 1/64" on either dimension. On plates over 24", warpage will not exceed 1/64" in 24" length and width.

Corrosion-Resistant: These Transite plates are made of an asbestos and cement combination. They cannot corrode.

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JM Johns-Manville
TRANSITE Core Plates

HEAT TREATMENT OF MAGNESIUM ALLOYS

(*Continued from page* 103)

for re-solution treatment. These results indicate the lamellar precipitate is almost completely redissolved by the time the sample has attained a temperature of 650 degrees Fahr.

From the foregoing data, the reason for the selection of 725 degrees Fahr. as a solution temperature is apparent. Higher temperatures promote *burning* of the as-cast alloy with consequent loss of properties. Lower temperatures will prolong the time required and possibly prohibit the complete solution of the *beta* compound.

Effect of Aging Temperature — In Table VIII are shown the effect of varying aging temperatures on physical properties. It may be seen from these data that no appreciable aging takes place at 250 degrees Fahr. This was borne out by metallographic examination which showed a solution treated structure at the end of 16 hours aging at 250 degrees Fahr. It should be further noted that 450 degrees Fahr. aging for 16 hours effects a decrease in ultimate and yield strengths.

There is very little difference between as-cast and previously solution treated and aged bars.

Effect of Aging Time—Fig. 7 shows the aging curves at 350 and 450 degrees Fahr. Each point represents the average of 12 bars except on the yield strength curve, where only 2 values were determined at each aging time indicated. The more rapid aging at 450 degrees is to be noted with the rapid decrease in ultimate strength and early increase in yield strength. The possibility of aging for 3 hours at 450 degrees is worthy of continued investigation into other properties such as fatigue strength, impact strength, etc.

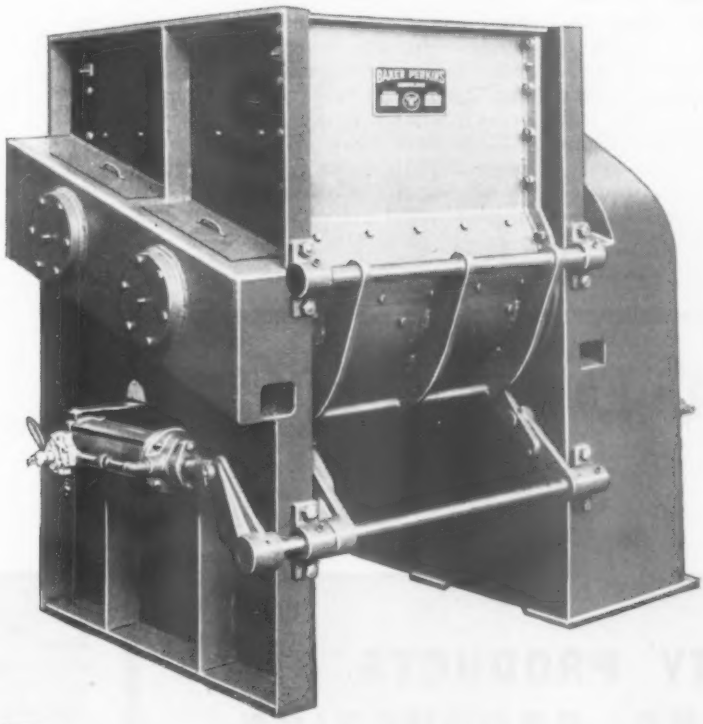
Aging at 350 degrees Fahr. was carried out to 160 hours with no significant changes in properties from those shown at 16 hours. The elongation decreased to 5 per cent and the yield strength increased to 19,500 pounds per square inch with no change in ultimate strength.

In Fig. 8 are curves showing the variation in amount of lamellar precipitate with time. It may be observed the precipitate forms most rapidly at 450 degrees Fahr. and not at all at 250 degrees. Comparison of Fig. 8 with Fig. 7 shows the ultimate strength is relatively independent of the amount of lamellar precipitate, while yield strength is more directly affected, as shown in Fig. 9.

Dimensional Changes During Heat Treatment—A brief study was made of the dimensional changes occurring during heat treatment. One, two and three-inch diameter slugs were cast. From these slugs, ¾-inch diameter bars 3 inches

(*Concluded on page* 238)

WHAT THEY SAY ABOUT BAKER PERKINS CORE SAND MIXERS



Workmen who operate them like the simple, labor-saving operation of Baker Perkins "Unidor" Core Sand Mixers. Baker Perkins Mixers mull, stir, and knead all in one operation, and they do not require any special aerating attachments. Result? They consistently produce sand batches of uniformly high quality with a minimum of labor.

Production Men rely on Baker Perkins "Unidor" Mixers because their swift action in preparing core sand gets any job of casting off to a flying start. They help assure uninterrupted foundry production because they deliver a thorough, homogeneous sand mix of greater permeability which improves casting quality and reduces chances of spoilage. "Unidor" Mixers can be loaded by weighing hoppers or power skip-hoists to suit the production set-up.

Foundry Managers endorse Baker Perkins "Unidor" Mixers because their high operating efficiency means a savings in production costs without sacrificing casting quality. "Unidor" Mixers distribute uniformly a thin layer of bond around each of the sand grains, assuring 100% benefit from the bonds, binders, oils, seal coals, pitch, or other compounds used. "Unidor" Mixers require practically no maintenance other than routine lubrication and occasional renewal of easily replacable steel liners and hardened steel wearing shoes. For further facts call or write Baker Perkins Inc., Foundry Equipment Sales Division, Saginaw, Michigan.

BAKER PERKINS BUILDS EFFICIENT FOUNDRY EQUIPMENT

(*Concluded from page* 236)

long were machined. These bars were then measured in the as-cast condition, after solution treatment and after solution treating and aging. The results are shown in Table IX.

From these data, it may be observed there is a rather slight growth during both solution treatment and aging. In practical terms this means a casting 3 feet long, if unrestrained during solution treatment, will increase in length by about 1/64-inch and after aging will have grown by slightly less than 1/32-inch over as-cast material.

Conclusions—The following conclusions may be drawn from the investigation for material with a grain size of 0.003-0.005-inch average grain diameter.

1. Pouring temperatures between 1330 and 1460 degrees Fahr. do not seriously affect static physical properties.

2. As-cast material must be slowly preheated to prevent undesirable *burning*. Previously heat treated material may be heated more rapidly and to higher temperatures without *burning*.

3. Solution temperatures between 700 and 750 degrees Fahr. give similar properties if no *burning* occurs.

4. Solution times of 12 hours minimum at 725 degrees Fahr. are required to dissolve the primary compound. The static physical properties are above the usual specification values before the compound is completely dissolved.

5. Drastic cooling from the solution temperature does not greatly improve static physical properties over air cooled properties.

6. Aging does not take place at 250 degrees Fahr. in less than 22 hours. Beyond 250 degrees the rate of aging increases rapidly with increasing temperature.

7. Ultimate strength is not seriously affected by the amount of lamellar precipitate formed during aging. Yield strength appears to be directly affected.

8. Dimensional changes during heat treatment are of the order of 0.01-inch per foot.

References

1. George, P. F., "A Numerical Rating Method for the Routine Metallographic Examination of Commercial Magnesium Alloys" A.S.T.M. preprint p. 3, (1944).

WOODISON'S

6

QUALITY PRODUCTS AID CASTING PRODUCTION

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Improves Melting Procedure

(*Continued from page* 119)

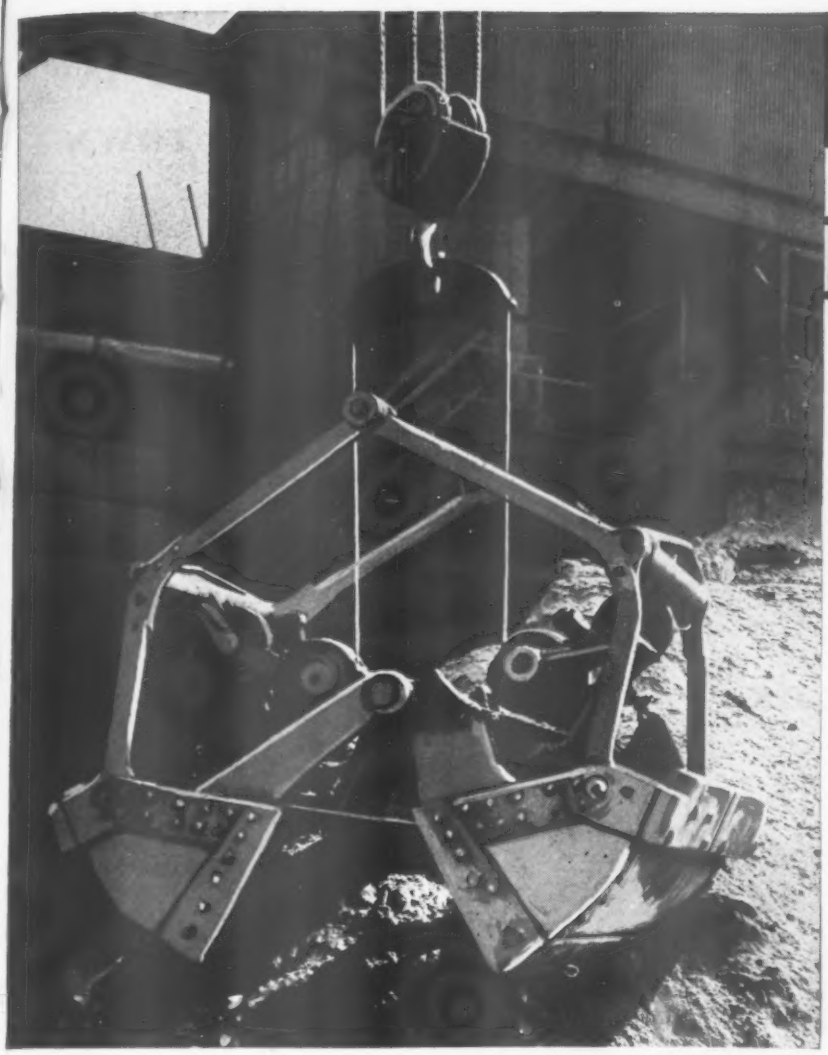
step, until rejected castings are now down to 7 per cent and usually lower. This is conclusively shown over a 10-month period during which many thousands of finished castings were made, with careful records kept for the case file. There have been periods when upwards of 180 castings came through with less than 5 that had to be scrapped. This is getting close to the margin of error (green sand molding) possible in making up flasks on steady high-production peaks.

With the clearing away of the underbrush of defects, it has been possible to make refinements in the pattern. The risers shown in the cope, Fig. 4, at the four main housing gates, were added to replace obvious shrinkage, and the size of the main riser (Fig. 6) was built up progressively. Such changes previously had shown no apparent effect although these and other gating changes had been among the many logical things attempted and discarded as of no perceptible value in the beginning.

All of the castings undergo pressure tests prior to finish machining. Steel jigs with rubber plugs are used in the pressure tests and air of 75 pounds in one opening and 30 pounds in another is applied with the casting submerged, as shown in Fig. 8. No leakers get by this test, though other minor defects may be revealed after finish machining and fine thread tapping. There are 14 threads to the inch, undercut in an unusual way, as may be seen on close inspection of Fig. 2.

A peculiar operating characteristic of induction furnaces is the fact that while there is no firing-up time loss at the beginning of a day, it is necessary to retain molten metal in the channels at all times. That is because an induction furnace generally is understood to be a low-frequency transformer, of which the metal itself, always molten, is the sec-

(*Concluded on page* 240)



EXTREMELY LOW HEADROOM

Designed Especially for Foundry Requirements

Blaw-Knox No. 309-F is a bucket whose exceptional width and limited closing power prevents it from digging into the foundry floor while handling moulders' sand, coke, etc. Its unique design permits fast and efficient operation in headroom as low as 6 ft. 7 ins. . . . Made in four sizes from ¾ to 4 cu. yd. capacity . . . For complete data on this and other Blaw-Knox Single Line Hook-on types, write for Catalog No. 2002.

Blaw-Knox Roller Gate Bucket

Where it is desirable to fill cores individually, this Controllable Discharge bottom dump bucket is fast and efficient. The discharge gate is opened or closed by an easy movement of the hand-operated lever. Illustrated is No. R-62-X Single Line Hook-on type of 2 yds. capacity.

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ARMY NAVY

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BLAW-KNOX CLAMSHELL BUCKETS

(*Concluded from page 238*)

ondary. A chamber above the channels holds the bulk of the molten charge, and uniform heat circulation is due to the electromotive stirring action of the electrical transformer fields. A roll-top cover is provided with high insulation, and 60 per cent less power is required to hold the metal in a molten state overnight than is used when charges are being melted and poured at the production rate of 150 pounds per hour.

The furnace melts at about 5 pounds of metal per kilowatt hour. With a demand rate in the Scottdale (Pittsburgh) area of $1.25 per kilowatt, an energy rate of 0.75-cent per kilowatt hour, and an efficiency of close to 75 per cent, melting costs compare not unfavorably, considering crucible replacements, repairs to combustion chambers, heat losses, etc., with our previous melting practice. When cost per pound of finished good castings is considered, it has been found in the present instance that the cost ratio is in the nature of 20 to 1 in favor of the induction unit. Actually the ratio is higher, since many of the principal defects due to previous melting practice were not perceived until after costly precision machining.

[1] "Induction Furnace for Electric Melting of Aluminum," by Manuel Tama, *Metal Progress*, November, 1943.

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Technical Methods
Presented in the hope that they will prove interesting and useful to you.
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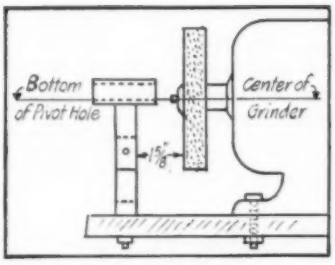
New Quick-set Dial Drill Sharpener Eliminates Guesswork...Keeps 'em Drilling Faster—Longer

Attached to the Drill Sharpener, it adjusts drill edges to the proper angle for precision grinding, putting drill sharpening on a quick, efficient basis.

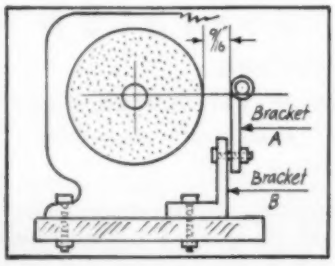
QUICK-SET DIAL easily and accurately adjusts Sharpener for sharpening drill from 5/32" to 1" sizes. Dial insures accuracy in measuring angles and clearances on twist drills, preventing trouble and making drills last longer. Dial-Set sharpened drills cut faster and more accurately, as the edges are alike and uniformly sharpened.

Precision built, calibrated and tested, unit is easy to set up and operate. Saves wear and tear on drill presses—prolongs drill life—cuts costs—improves quality—speeds output.

Another thing worth remembering is Wrigley's Spearmint Gum. That familiar red, white and green package which always meant "a help on your job." No more of this famous brand and flavor is being made for anyone now—even for the Armed Forces overseas—as Wrigley's stockpile of finest quality raw materials is all used up. But—remember Wrigley's Spearmint—The Flavor Lasts.



Front view of grinder



Side view of grinder

You can get complete information from Amoraco Industrial Specialties, 122 S. Michigan Ave., Chicago 3, Ill.

Z-59

OPERATES BIG SHOP IN SMALL TOWN

(*Continued from page 112*)

floor, setting the cores, closing the copes over the drags, making up the runners and clamping cope and drag together.

Flask joints are machined to a true plane for the double purpose of insuring a perfect sand joint when the mold is closed, and also to insure the accurate seating of the chaplet supports. A number of small bosses are provided at strategic points on the pattern face in the cope and in the drag. Corresponding recesses are formed in the core. The additional thickness in these areas gives the metal a better grip on the chaplets and eliminates leakage when the castings are water tested before shipment, and later when they are placed in service as parts of heating units. Chaplets are double end or stud type, two pieces of tin plate joined by a wire stem in the center. Short chuck bars extend from the main flask bars in the cope and in the drag. The outer or free end of the chuck bar is circular in cross section and the lower end is machined or ground to sit exactly on the small chaplet boss on the pattern. With this arrangement chaplet setting is positive and accurate, also it is merely a routine and automatic detail involving no special training or skill on the part of the operator.

Gated at Both Ends

The casting is gated at both ends. Two 1-inch diameter sprues connected by a pouring basin at the top deliver metal at each end to a runner in the cope face and extending almost all the way across the end of the casting. Metal from the runner enters the mold cavity through a number of small flat gates. After the mold is closed, one member of the crew places a small runner box, 4 x 4 x 12 inches, in position to enclose a rectangular wood block that covers both sprues. Sand is packed around the block and when the block is removed it leaves a smooth, clean runner basin. A piece of perforated tin plate is laid over each sprue opening to prevent any dust or dirt entering with the first dash of iron.

Instead of placing the mold on a smooth concrete floor, it is laid on a sand bed about 2 inches thick. A rectangular frame approximately the same area as the bottom of the drag, made of thin steel strip and provided with a number of lateral bars extending from side to side, is laid on the floor and filled with sand. The surplus sand is scraped off flush with the top and the frame is removed. The sand provides a resting place for the mold, while the lateral channels serve as vents for the escape of gas and steam generated when the mold is filled with metal. The method is simple, rapid and highly efficacious.

Cores for the section and for all other

(*Continued on page 242*)

STAND A SHOCK?

CARBON AND GRAPHITE can be heated to incandescence and plunged into cold water without the slightest harmful effect!

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But these materials also have other equally important qualities. So you must think of them in terms of *all* their properties . . . in combinations possessed by no other materials.

It will help you to understand why carbon run-out troughs give up to six months' service in steel mills . . . why graphite anodes made the mercury-arc rectifier practical . . . why graphite molds for ferrous and nonferrous metals don't crack, spall or stick . . . why graphite bubble caps retain their original dimensions throughout the heat cycle of any chemical tower . . . and why "Karbate" heat exchangers resist practically all acids, alkalies and solvents.

Our nearest Division Office will gladly furnish full details.

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KEEP YOUR EYE ON THE INFANTRY . . . THE DOUGHBOY DOES IT!

(*Continued from page 240*)

castings are made in a section of the foundry 40 x 200 feet parallel to and adjoining the main foundry building from which it is separated by a row of steel columns. The baked cores are transported by trucks to the various floors where they are placed in the molds. The cores are made on a long battery of roll-over machines close to the outer wall, and in three core blowing machines. They are then placed on racks and transported to the ovens by truck. Two ovens are located in the center of the floor near one end of the core room, and two others are similarly located about the same distance from the other end. A tower type oven occupies space in the center. All ovens are fired with natural gas, and the temperature and ventilation are under close and automatic control.

Core sand unloaded from cars through a trap door in the low roof, is stored in a room at one end of the coremaking department. Mixtures in wide variety are compounded from two base sands, a clear uniform grain size lake sand, and a fine grain bank sand. Cores that stand high on the plates, or for any other reason that necessitates extra green bond strength, contain varying amounts of bank sand, and in some instances a small amount of cereal binder. At the other extreme, for instance, the boiler section cores are made exclusively of lake sand bonded with a proprietary core oil. Amount of oil in the different classes of cores also varies to a considerable extent from 1 to 72 ratio in outside or block cores, to 1 to 48 in the section cores.

Used on alternate days, iron is melted in two cupolas lined to 70 inches inside diameter with a bosh above the tuyeres 60 inches diameter. Method of operating and charging the cupola is worthy of special comment. Iron for the various castings is divided into two main classifications, hard iron and soft iron. Each hard iron charge contains 1300 pounds pig iron, 600 pounds steel scrap, 600 pounds foreign scrap, 1000 pounds shop scrap. Each soft iron charge contains 1800 pounds pig iron, 1400 pounds shop scrap and 300 pounds of steel scrap.

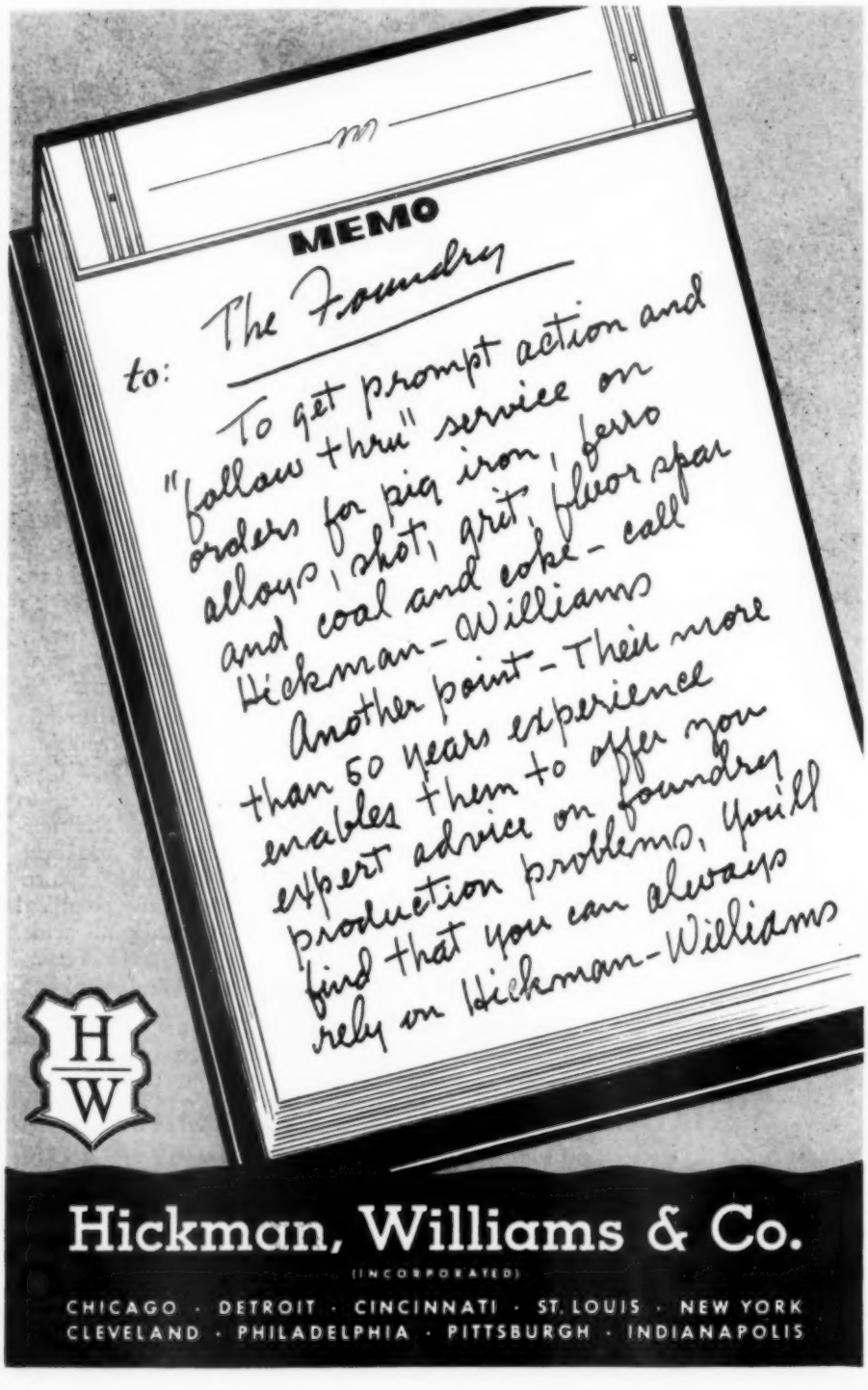
Charging Work Simplified

One craneman makes up the charges and places them in the cupola. Two drop bottom steel buckets are placed in a depression in the yard containing a roller conveyor and the platform of a scale. The dial of the scale is mounted on a rail in front of the cupolas in plain view of the crane operator. The metal components of the charge are picked up by a magnet and placed in the buckets. With the nicest degree of skill and accuracy the operator drops the material into the bucket until the correct weight is indicated on the scale. The loaded bucket is then pushed to the end of the depression near a railroad track where an attendant adds 400 pounds of coke from a boxcar or from a pile maintained in the vicinity. Approximately 100 pounds of limestone also is added at this stage. The craneman then picks up the loaded bucket, inserts it through the door of the cupola and trips the bottom. The bucket then is returned to the scale in the yard and the cycle is repeated until the entire amount for the daily heat is in the cupola.

The threshold of the charging door opening is a heavy gray iron casting set at a steep angle. Cast iron blocks form the lining of the cupola for a distance of 3 feet below the charging door. These blocks resist the abrasion incident to the falling charge.

Method of lighting the coke bed in the cupola differs to a considerable extent from that usually employed where wood is placed on the sand bed, or a gas or oil torch is inserted in the tap hole, one of the tuyeres, or through a special opening at the back or side. In this instance a special device has been developed. A 2-inch pipe bent to form a ring 4 feet in diameter, pierced with a number of ¼-inch holes and connected by a short length of hose to the gas main, is laid on the ground. A charging bucket filled with coke is placed over the ring and the gas flame is lighted. The conc bottom of this particular bucket is a grate cast in four sections and bolted to

(*Concluded on page 244*)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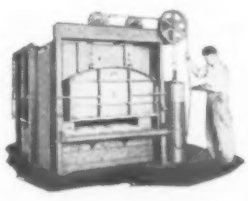
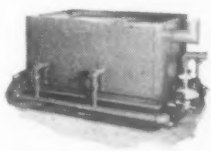
Uniform Heat Treating of Steel Parts

40,000 lbs. Per Load

This Radiant convection recirculating car type furnace holds 40,000 lbs. of fabricated steel parts and raises them to 1150°F. at a rate of 6000 lbs. per hour. It holds this temperature to plus or minus of 5°F. Sand sealed throughout including the door, this furnace is practically leak-proof. Distributed by ducts, flue gases blow across the heating chamber from wall to wall, thus bathing the entire charge uniformly. Convection furnaces are built and guaranteed by us up to 1700°F. Radiant Combustion tailor-made furnaces, designed to definite specifications, will increase production and efficiency in your heat treating department. Write for information.



BOX TYPE FURNACE heats 2"x3'x7' steel plates. Combination gas or oil fired, even temperature, heavy construction for long life. Hearth area is 3' x 8'.



RECTANGULAR LEAD POT, annealing 75mm. shot, production 100 shells per hour, 42" long x 18" wide x 14" deep inside. Constructed of 3/4" steel plate. 1250° F. temperature. Hood and flueing not pictured.

ROTARY TYPE 10 ft. hearth operates at 1650° F., heat treats 2000 lbs. of steel per hour. Smooth operating due to special hearth mechanism. Six of these now operate in one plant.

Radiant Combustion, Inc

BUILDERS OF EVERY TYPE (OIL, GAS, ELECTRIC) OF HEAT TREATING FURNACE

WARREN, OHIO

Consulting Service

with particular reference to

METAL MAKING

and

FOUNDRY OPERATING PROBLEMS

STEEL • MALLEABLE
GRAY IRON
NON-FERROUS

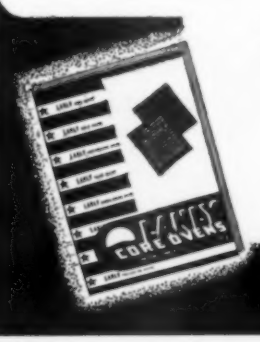
W. HARVEY PAYNE & CO.

PRACTICAL FOUNDRY ENGINEERS

4040 BOARD OF TRADE BLDG. — PHONE WABASH 3550
141 WEST JACKSON BLVD. • CHICAGO (4), ILL.

LANLY
CORE AND MOLD OVENS

If interested in new equipment or remodeling of ovens for core baking, mold drying or casting conditioning, write for this catalog.



It illustrates a complete line of equipment, describes the features responsible for highly efficient and economical operations and contains a list of Lanly oven purchasers whose known high standards are an implied endorsement of Lanly Ovens.

THE LANLY COMPANY
750 Prospect Ave. CLEVELAND, OHIO

(*Concluded from page 242*)

gether. When the coke is burning briskly, the craneman lifts the bucket, lowers it into the cupola and discharges the burning coke. Remainder of coke for the bed is then added and allowed to burn by natural draft. Before charging any metal the blast is turned on for about 20 minutes to settle the bed and raise the coke to a high temperature. As a result of this method, the first iron is tapped at a temperature of approximately 2800 degrees Fahr., the same as the remainder of the heat.

Method of raising the cupola bottom doors is simple and highly efficient. A 1-inch hole was drilled and tapped near the center of each half door about 6 inches back from the lip. When the time comes to lift the door, the operator screws an eye bolt in the hole and attaches it to the crane hook. The craneman pulls the door up into place.

Castings are trucked to a long building about 100 feet from the main foundry building. Here the castings are cleaned according to classification in a battery of ten tumbling barrels, three mechanical blasting units, and a pressure blast chamber through which the larger castings pass suspended on hooks. From this point the castings are loaded in steel containers and trucked to the grinding and chipping departments and finally to the inspection and shipping department.

Adds New Cleaning Compound Plant

Homestead Valve Mfg. Co., Inc., Coraopolis, Pa., has opened a new plant at Edgeworth, Pa., for the manufacture of compounds used in steam spray and other methods of cleaning machinery and other war materiel.

CAST RUNNER: This cast runner, made by Baldwin Locomotive Works, is part of a turbine for a Mexican hydroelectric power plant. The runner, 70 inches in diameter, is small compared with others Baldwin has built, some of which are more than 20 feet in diameter to accommodate a relatively low "head" of water

what users discover about INTERNATIONAL electrodes

Leading *producers* of electric furnace steels have been consistent users of INTERNATIONAL Graphite Electrodes for 15 years. So have principal electric furnace *manufacturers.* Neither could afford to rely on them for quality steel production if they were not confident that INTERNATIONAL electrodes fully measure up to every important standard by which acceptable electrodes are judged.

Users have proved this fact to their own satisfaction in the severest test of all—in actual furnace operation under a wide range of production requirements. Thus, they have found that INTERNATIONAL electrodes can be depended upon to have all the physical, electrical and chemical properties essential to maximum service, at minimum cost per ton of production.

Present users have discovered, too, that INTERNATIONAL stands for good service; offers helpful recommendations for applying and using electrodes most efficiently. Behind INTERNATIONAL development, manufacturing, and service facilities is much valuable experience that is yours for the asking. Write us for additional details.

International Graphite & Electrode Corp.

SAINT MARYS, PA.

NEW EQUIPMENT & SUPPLIES

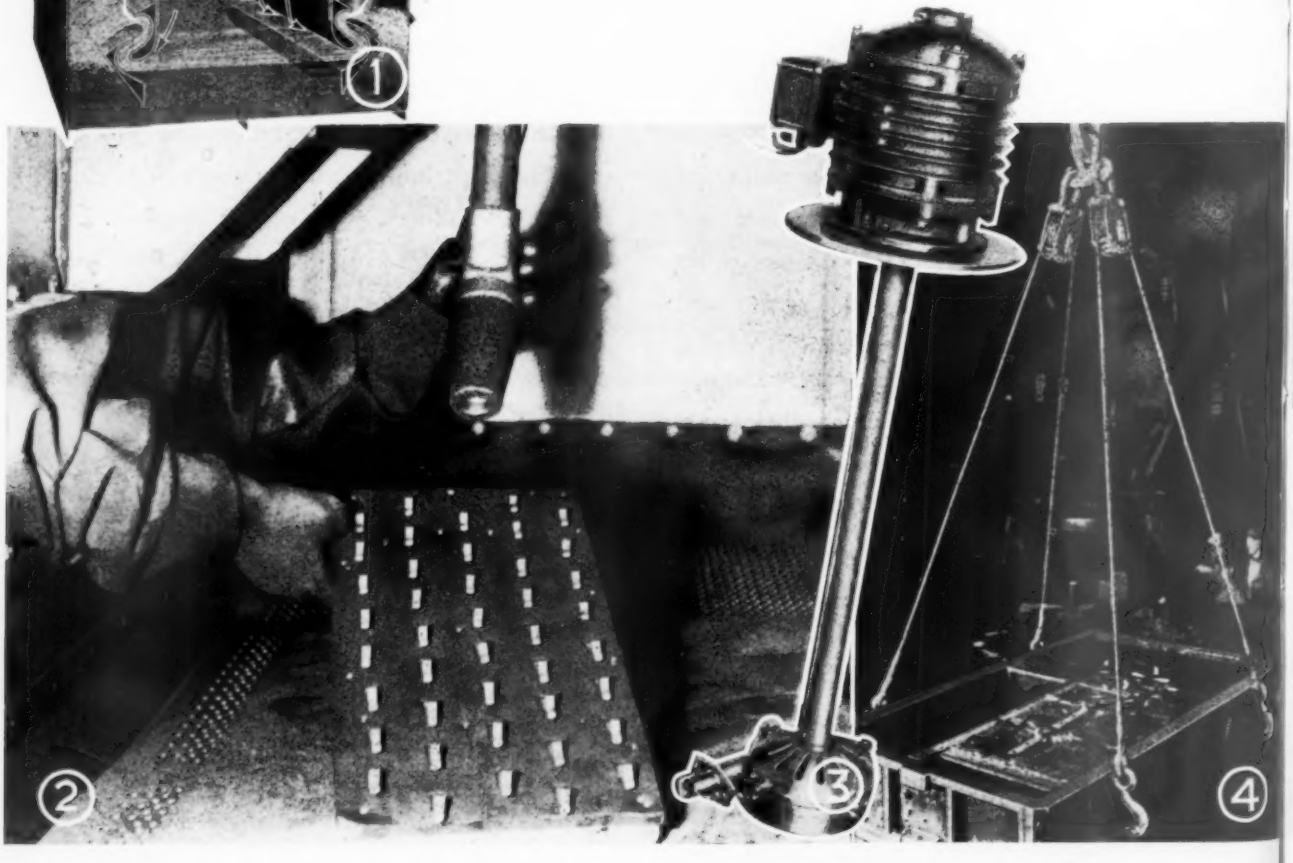
(1)—Dust Collector: American Air Filter Co. Inc., 215 Central avenue, Louisville 8, announces the latest addition to its series of dust collecting equipment, a type based on the principle of hydrostatic precipitation. Air, forced through the sinuous passage of the stationary impeller, induces a heavy sheet of water to move along the surface of the impeller blades, creating a water curtain in the form of a reverse "S" through which the air must penetrate. The unit is compact, and its absence of moving parts is said to make it ideal for safe control of magnesium and explosive dusts, collection of linty and adhesive dusts from buffing operations, and exhaust of corrosive gases. It is made in three classes and 13 sizes for exhaust of air volumes from 1000 to 25,000 cubic feet per minute.

(2)—Blast Protection: Resistoflex Corp., Belleville, N. J., has developed a flexible rubber-like plastic, called compar, which offers strong resistance to abrasion. When used to protect the perforated bottom of a sand blast cabinet it is said to have shown a life 250 times that of ordinary steel plate. In the illustration the wooden tray which holds small parts to be sand blasted also is protected by a sheet of the material.

(3)—Sludge Pump: Claude B. Schneible Co., 2827 Twenty-fifth street, Detroit 16, has made available a vertical discharge model of its special pump which was developed originally for use in connection with the company's wet-method dust collecting dewatering systems. In addition to handling abrasive sludge in such service, it is likewise adapted for pumping other abrasive materials, slurries and dirty water. Previously it was furnished only in horizontal discharge types. The housing is made of abrasion-resistant material, and its top or cover serves as a strainer. The totally enclosed drive shaft is protected by a quill tube which serves as a structural member. The impeller is readily accessible and the bottom of the pump housing is removed easily for parts replacement. Discharge may be changed to any one of four positions. The pump is available in sizes from ⅜-inch to 1¼ inches.

(4)—Lift Sling: Macwhyte Co., Kenosha, Wis., now is offering its patented level-lift sling in ¾, 1½, 3 and 6-ton capacities, the two smallest sizes being new additions. In operation, the block containing wire rope is put on the crane hook, the latter is spotted over the approximate center of gravity of the load and floormen attach the sling to the load. As the crane hook is lifted, the rope automatically adjusts itself through the block. In so doing, one sling leg of rope becomes longer than the other, and as the load pulls on the rope,

(*Continued on page* 248)



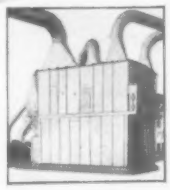
YOU CAN'T GET *Efficient* DUST or FUME CONTROL "OFF THE SHELF"

Like a good fitting suit, tailored to the individual's measurements, a Kirk & Blum dust or fume control system is *custom-built* to fit the special needs of each particular job.

That is why Kirk & Blum systems are unmatched for efficient, dependable, economical performance . . . why leading industries throughout the nation turn to Kirk & Blum for service in this important field.

For 38 years our Engineering Staff has specialized in dust and fume control.

KIRK AND BLUM



BUY MORE WAR BONDS *for* TOTAL VICTORY

The procedure of our staff involves three main steps: (1) Analysis of your special dust or fume control problem; (2) Selection of the right units — wet, dry, or centrifugal — for your particular needs; (3) Design and installation of a complete system *guaranteed* to give you the results you want.

You can avoid many "headaches" in dust and fume control by getting the experienced, unbiased counsel of Kirk & Blum Air Engineers. For details, write to The KIRK & BLUM MFG. CO., 2808 Spring Grove Ave., Cincinnati 25, Ohio.

Send for Booklets

Dust Collecting Systems in Metal Industries

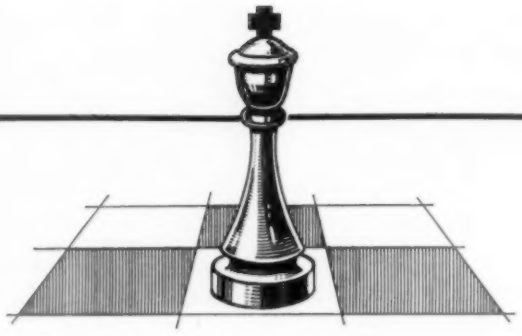
Fan Systems for Various Industries

Blower Systems for Woodworking Plants

Industrial Ovens

Cooling Systems for the Glass Industry

Data on Kirk & Blum Production Facilities.

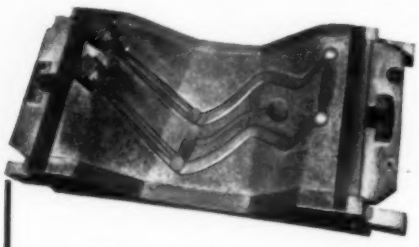


To check the king, all approaches must be analyzed

Far-sighted analysis holds as true in building as it does in chess. In planning a modern foundry or an addition to an existing structure, many moves must be considered: design, heat, light, ventilation, arrangement of stairs, elevators, stock rooms, wash rooms, etc.; layouts and location of equipment, inter-departmental movement of raw and unfinished materials. When these details are worked out in advance, considerable time and money is saved; moreover, the plant owner is assured of more efficient operation. Our experience as foundry engineers is at your disposal; case histories are also available.

A. A. WICKLAND & COMPANY
Engineering Bldg., Chicago 6, Illinois

FOUNDRY ENGINEERING SPECIALISTS



COPE is entirely made of TAMASTONE.

DRAG is of TAMASTONE with a metal gate.

Note irregular shape of manganese casting below.

"500% INCREASE *with* TAMASTONE"

Reports the Hunter Foundry Co., Chicago

With original equipment, gated pattern and hard match only 10 to 12 molds per day were possible. Through the use of TAMASTONE Pattern Compound (100 lbs.) the job is converted to separate cope and drag patterns (shown here) and production is now 60 molds per day. This new method enables the foundry to draw pattern from the sand as offset parting, eliminating the amount of sand to be lifted in the cope. Equipment is gated for pouring manganese.

Savings from 300 to 500% are possible in your plant! Write for literature!

14" x 24" SLIP FLASK is designed to conform with extremely irregular parting line and manganese casting. Cope 11" high with 6" offset and 4" drag.

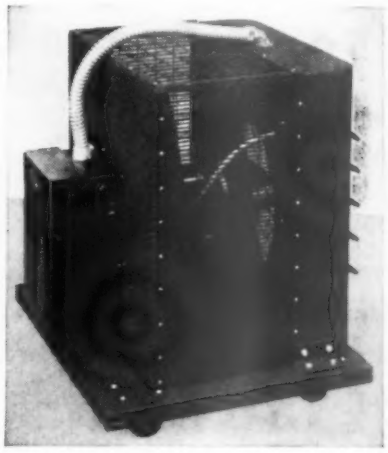
TAMMS SILICA COMPANY
228 N. LA SALLE ST. CHICAGO 1, ILLINOIS

(*Continued from page* 246)

the block sheave pulls down against a brake which prevents slippage. The load then is lifted level.

Burn Ointment: Davis Emergency Equipment Co., Newark, N. J., is introducing Hydrosulphosol ointment, claimed to be the most advanced and successful treatment for painful burns. It is stated that the ointment and the liquid solution have been used satisfactorily in hospitals over a period of 4 years on all types and degrees of burns. Published statements indicate that the ointment, a chemical barrier to oxygen, not only prevents penetration of oxygen to the scarred tissues, but by suffusing the damaged tissues, breaks down oxidized cells and helps stimulate the natural restoration of injured tissues.

Portable Air Heater: Electric Air Heater Co., division of American Foundry Equipment Co., Mishawaka, Ind., is prepared to supply portable air heaters suitable for many loca-

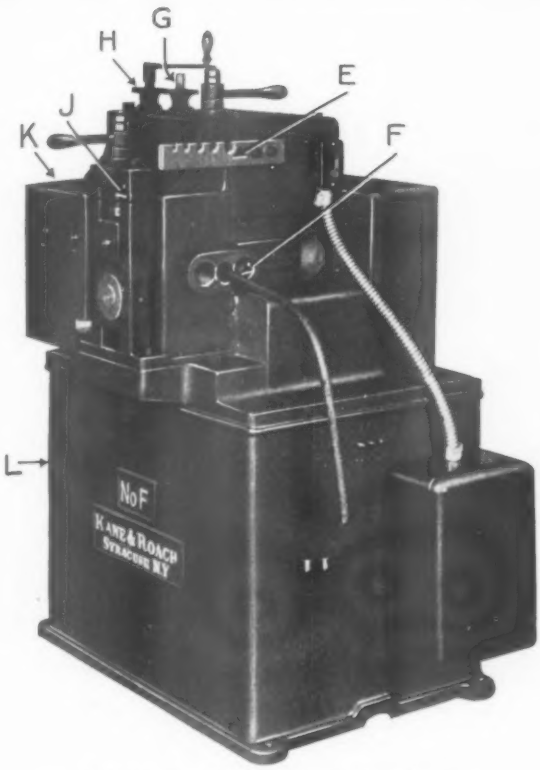


tions. The unit originally was designed for heating emergency huts for men working outdoors in a steel plant. Heater elements, fan motor, contactor and switch are mounted on one base provided with casters. The heater elements are sheathed resistors cast in one-piece finned aluminum castings.

Transmission Belt: Goodyear Tire & Rubber Co., Akron, Ohio, has developed a new type transmission belt which utilizes steel cables instead of cord or fabric for the carcass. Cables are enclosed in an envelope of non-load carrying fabric. One half the cables are twisted to the right and one-half to the left to insure a true running belt. It is claimed the belts are practically unbreakable. They resist lubricating oil and high temperature, can be used in narrow widths, adapted to lower belt range speeds, practically stretchless and shrinkless, and require no taking up

(*Continued on page* 250)

No prudent foundryman would sneeze at savings of $75.00 to $150.00 a month



K. & R. No. F 5-Roll Core Wire Straightener

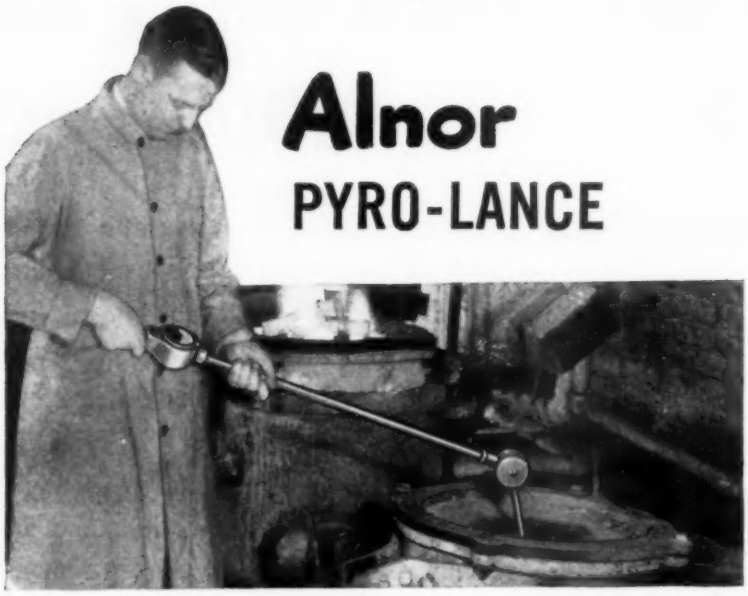
E KINK BAR, HARDENED.
F FEED FUNNEL, HARDENED.
G ADJUSTING SCREW, TOP ROLL SHAFTS.
H LOCK NUT, ADJUSTING SCREW.
J OUTER BEARING, PINCH ROLL SHAFTS.
K CAST IRON GUARD, ENCLOSED ROLLS.
L CABINET BASE, ENCLOSES AND PROTECTS MOTOR.

In this era of easy money, monthly savings of $100, might be considered peanuts, but smart management pyramids small savings into big profits. The KANE & ROACH CORE WIRE STRAIGHTENERS, for example, relieves men of the task of straightening bent core wire by hand. It salvages used wire by the ton, quickly, cheaply and efficiently. Scores of foundries have purchased three and four K. & R. machines. K. & R. machines restraighten used core wire over and over again, just as long as the wire is usable. A cutoff shear can be supplied to be used in conjunction with the Core Wire Straightener for straightening and cutting to length new wire from the coil. Core Wire Straighteners are built in two sizes to straighten wire from .080 up to and including ¾" and can be furnished with five, eight or nine rolls. Specifications and quotations will be furnished promptly on receipt of your request giving diameters of wire to be straightened.

REPORT FROM ONE USER
Typical Week's Record With Straightener

	12 ga.	8 ga.	6 ga.
Monday	60	247	107
Tuesday	62	258	50
Wednesday	58	279	
Thursday	60	229	
Friday	62	270	192
Lbs. each size per week	302	1283	349
Per 100 lbs.	$5.15	$5.00	$5.00
Salvage	$15.55	$64.15	$17.45
Total Salvage			$97.15
Wages (Including Handling and Sorting Time)			26.00
Saved			$71.15

KANE & ROACH, INC.
SYRACUSE, N. Y.
ESTABLISHED 1887



Alnor
PYRO-LANCE

built to stand up in foundry service

This portable pyrometer is built with a rugged shock-resisting movement and an enclosed extension thermocouple—a unit especially designed for reliable foundry service. It gives you the quick, accurate temperature readings so important to efficient, economical production of sound castings.

The Alnor Pyro-Lance is especially suited to use with molten brass, bronze, copper, aluminum bronze, magnesium alloys, and similar metals where temperatures are not over 2300 degrees F. The special enclosed thermocouple takes true readings below the surface, unaffected by dross or surface conditions. Standard range is 0-2500 F.

Write for bulletins.

ILLINOIS TESTING LABORATORIES, INC.
420 NORTH LA SALLE STREET • CHICAGO 10, ILLINOIS

1905 **Strand** FLEXIBLE SHAFTS 1945

SWIVEL BENCH TYPE MWH

FLEXIBLE SHAFTS AND MACHINES
ONE HUNDRED TWENTY-FIVE TYPES
LARGEST EXCLUSIVE BUILDERS

VERTICAL THREE SPEEDS

SEND FOR CATALOG No. 29

•

FLOOR TYPES SWIVEL YOKE MOUNTINGS

Hand Cut High Speed Steel Rotary Files and Ground Cutters

N. A. STRAND & COMPANY
5001-5009 No. Wolcott Ave. • Chicago 40, Ill.

(*Continued from page* 248)

after tension is established. Almost complete elimination of creep on the pulleys results in power saving, improvement in speed regulation from no load to full load and in marked reduction in pulley face and belt face wear. The belts are produced in practically the same range of widths and lengths available with cord and fabric carcass belts.

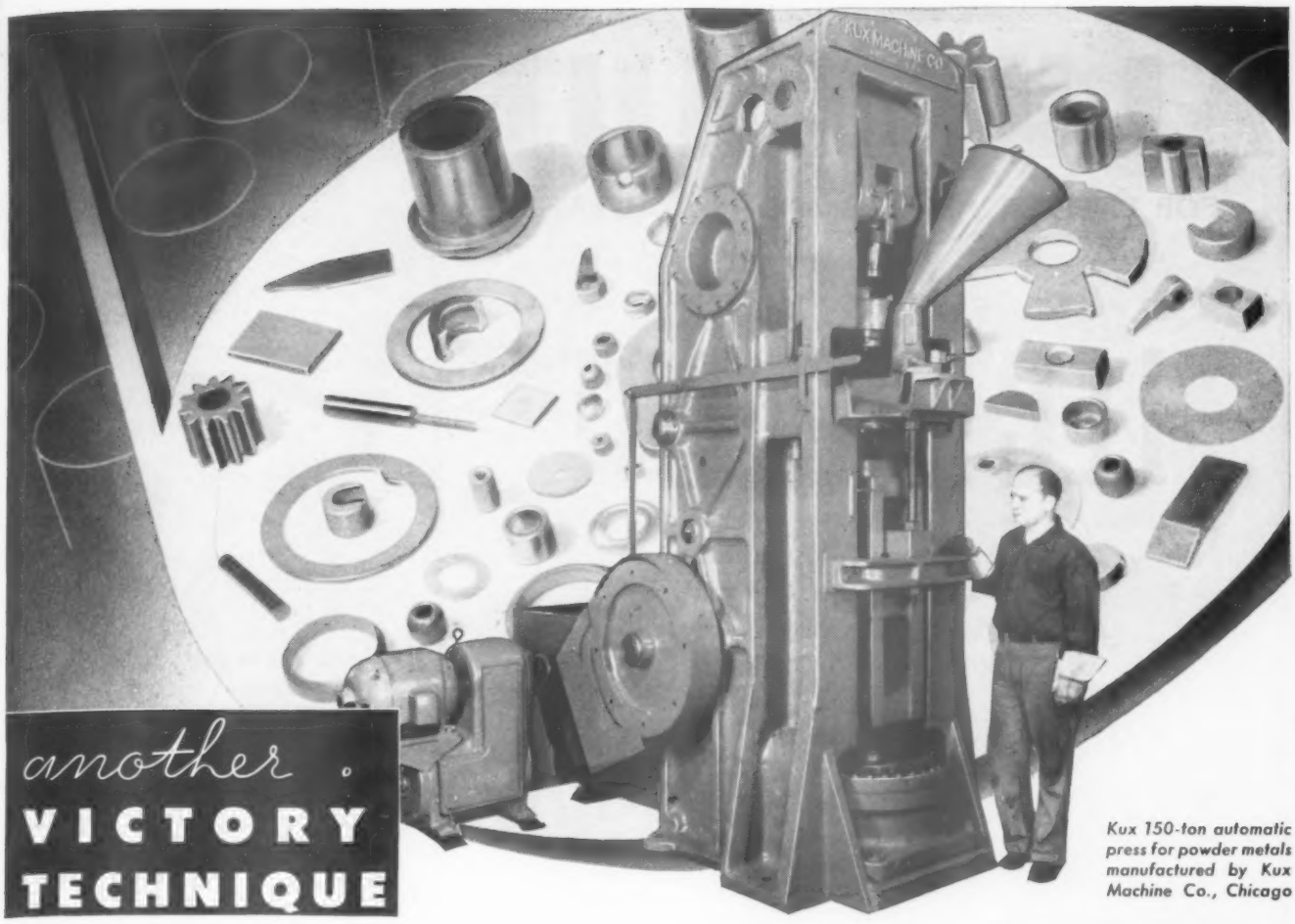
Cutting Calculator: Grove Calculator Co., 6644 Cottage Grove avenue, Chicago 37, announces a vest-pocket plastic slide rule that instantly determines the correct speed for all metal cutting operations. Enables machinists and supervisors to select most efficient cutting speeds for high speed and carbide machining operations. Readings from 10 to 1000 feet per minute can be obtained.

Stock Cart: Lyon Metal Products Inc., Aurora, Ill., has developed a stock handling cart for expediting plant operations. The cart shown in the accompanying illustration is 30 inches long,

16 inches wide and 32 inches high overall. It may be furnished with an extra center tray. The desk accessory is 16 inches wide, 14 inches deep with a 5-degree slope. The cart is finished in green baked enamel and is shipped set up.

Heating Pot: Kindt-Collins Co., 12651 Elmwood avenue, Cleveland, has developed a heating pot for a variety of low melting point materials such as glue, shellac, kerosene, turpentine, waxes, fusible metals and certain types of plastics. The pot is electrically heated, completely automatic, permanently wet, fire and explosion proof, and maintains a uniformly low temperature. The heating element, thermostatically controlled, operates with a vacuum sealed fluid circulating between the inner and the outer shells of the pot. Once filled, the fluid never requires replacement. A pot full of glue from a cold start comes to maximum temperature in 30 minutes. The current is on 15 minutes and off 45

(*Continued on page* 252)



another ·
VICTORY TECHNIQUE

Kux 150-ton automatic press for powder metals manufactured by Kux Machine Co., Chicago

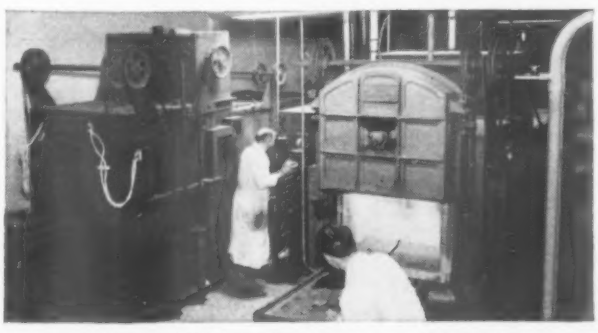
A NEW NOTE IN THE METALLURGICAL SYMPHONY...
Powder METALLURGY

BEFORE the ancients worked with molten metal they fabricated simple implements from metal powder. Yet it was not until the vast needs of World War II that the development was forced to practical proportions. Now thousands of parts pressed from powdered metals and sintered in a controlled atmosphere furnace are being used in weapons of war and accessories at a great savings of time or cost or both.

One order of 40,000,000 small parts was produced for the navy at the rate of 520 pieces per minute by powder metallurgy. A piece of Ordnance from powder metal effected a saving in cost of about 70%. And the same story applies to a vast multitude of parts from powdered iron, bronze, aluminum, silver, tungsten, platinum.

Powder Metallurgy is one of the many Victory Techniques that have infinite postwar possibilities and about which you must learn if you are to meet competition. Your Lindberg representative is eager to help you in any possible way. Discuss with him the new developments in powder metallurgy, sintering, brazing, and treatment of metals by heat in any form.

LINDBERG ENGINEERING COMPANY
2453 WEST HUBBARD STREET, CHICAGO 12, ILLINOIS



A Battery of Lindberg Brazing Furnaces in operation

ARMY E NAVY

Lindberg FURNACES

SUPER-CYCLONE for hardening, normalizing, annealing, tempering
CYCLONE for accurate, low-cost tempering and nitriding
HYDRYZING for scale-free and decarb-free hardening

ALUMINUM

FOR PATTERNS, PLATES AND MATCHPLATES

USE

Trade **LECTRO-PAT** Mark

The Aluminum Alloy made especially for this exacting purpose. All standard and any special alloys are available.

THE CLEVELAND ELECTRO METALS CO.

CLEVELAND, OHIO

Shelton Metallic Filler

★ QUICK DRYING

★ HARD SETTING

CASTING Surface Patching Cement

Foundrymen strive to make each casting perfect. If, however, surface imperfections occur, use the filler that dries faster, sets harder, takes file finish. 25 years a favorite in the foundry trade. Dark and light shades.

Shelton Metallic Filler is packed in cans of 1, 5, 10, 25 and 100 lbs. Write for sample.

Product of

AMERICAN CRUCIBLE COMPANY

SHELTON, CONN.

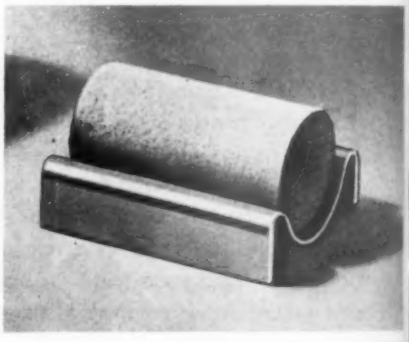
(*Continued from page* 250)

minutes every hour. Standard models, of 2-quart capacity, have a temperature range from 142 to 162 degrees Fahr. Pots for special heats can be furnished.

Band Saw: W. O. Barnes Co., Inc., 1297 Terminal avenue, Detroit 14, announces a new skip tooth band saw of special design for cutting nonferrous metal, plastics, compositions, fiber, wood, etc. The new skip tooth provides greater

chip clearance and practically eliminates loading and clogging with high speeds and heavy feeds. The saw is of hard edge, flexible back construction and fits any standard band saw machine. Greater economy is claimed because it can be used until completely worn out. Requires no resharpening.

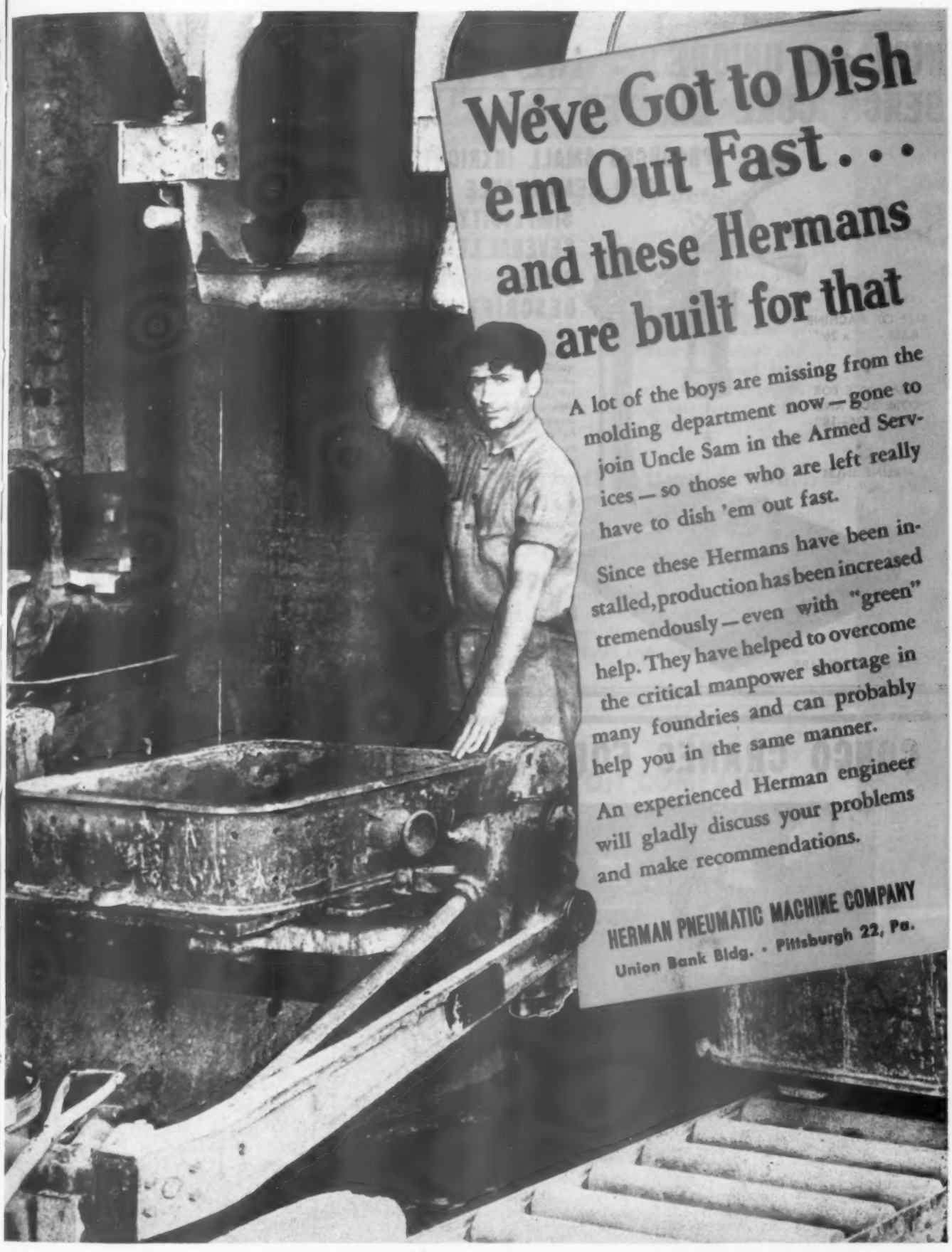
Specimen Dryer: Harry W. Dietert Co., 9330 Roselawn avenue, Detroit 4, announces that sand specimen dryers now are available for 2-inch and 1⅛-inch diameter sand specimens. It



is stated these dryers are useful for holding the laboratory sand specimens to size during the drying or baking period, particularly for low strength core specimens. The dryers are formed from 1/16-inch thick brass.

Regulator: Bloom Engineering Co., Pittsburgh 12, has made available a steam-oil pressure ratio regulator which automatically proportions the steam pressure to a group of steam-atomizing oil burners in relation to oil pressure. It is claimed that the regulator eliminates dirty oil burners, improves oil organization, provides proper flame condition and eliminates many variables of manual adjustment. Oil and steam flow through a chamber at the top of the regulator, and

(*Continued on page* 254)


We've Got to Dish 'em Out Fast . . . and these Hermans are built for that
A lot of the boys are missing from the molding department now—gone to join Uncle Sam in the Armed Services—so those who are left really have to dish 'em out fast.
Since these Hermans have been installed, production has been increased tremendously—even with "green" help. They have helped to overcome the critical manpower shortage in many foundries and can probably help you in the same manner.
An experienced Herman engineer will gladly discuss your problems and make recommendations.
HERMAN PNEUMATIC MACHINE COMPANY
Union Bank Bldg. • Pittsburgh 22, Pa.

MOLDING HERMAN MACHINES

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH, PA.

NEW and UNIQUE! » THE CARTRIDGE BENCH CORE BLOWER

SPECIFICATIONS

A
SIZE OF MACHINE BASE—20" x 26"

B
CLEARANCE FOR CORE BOX AND CARTRIDGE—18"

C
AIRLINE INLET ¾"

WEIGHT—200 LBS.

PRODUCES SMALL INTRICATE CORES WITH REMARKABLE SPEED AND SIMPLICITY. IN USE IN SEVERAL LEADING FOUNDRIES. WRITE FOR DESCRIPTIVE FOLDER.

. . . . fills the need for a simple, flexible blower and has raised quantity and quality of work at a minimum of expense. It requires no large volume of air for small cores and no adjustment for difference in height, size or shape of coreboxes is necessary. Coreboxes can be very light. The need for strict moisture control of sand has been greatly reduced, permitting the use of almost any core bench sand. Thus by eliminating sand trouble the quality of intricate work that may be done with the machine is greater than by any other method of blowing.

(Patents Pending)

REDFORD IRON AND EQUIPMENT CO.
21315 W. McNichols Rd.
DETROIT 19, MICH.

CONCO CRANES FOR FOUNDRIES

The ideal foundry crane—compact, strong, easily and quickly operated. Throughout the country foundries large and small—having important war contracts—are using this Conco Low-Headroom-High Hook Lift Crane. With many outstanding construction features, it is designed to meet the needs of today. Write us for complete information.

CONCO ENGINEERING WORKS
DIVISION OF H. D. CONKEY AND COMPANY
19 GROVE STREET — MENDOTA, ILLINOIS

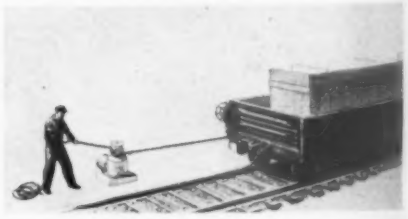
(*Continued from page* 252)

are separated by a flexible diaphragm which is controlled by a spring. Diaphragm is adjusted to provide a steam pressure equal to or greater than the oil pressure.

Air Tempering: Whiting Corp., Harvey, Ill., has developed a gas-fired air tempering unit for the performance of a three-fold service: Relieves the partial vacuum created by exhaust systems; supplies correctly tempered air to replace evacuated air and permits the existing heating system to function nor-

mally; uniformly distributes the tempered air. Instead of permitting infiltration of cold air through a multitude of openings, it is possible to admit the necessary volume of correctly tempered air at selected points. Because of perfect combustion of the gas and the large amount of fresh air handled, there are no odors or condensation. Each unit is provided with a safety pilot which stops the flow of gas and the fan, should ignition fail. It is claimed the unit can supply all the heat required where no other heating means is available.

Car Puller: American Engineering Co., Philadelphia 25, announces a car puller in which the barrel, gear box and motor are integrated in a single



streamline unit. Starting line pull is 5000 pounds with a single line, more with various block combinations. Dimensions, features and applications are presented in a colorful folder, available upon request.

Gaskets: Sherwin-Williams Co., Cleveland, has developed a new type gasket consisting of a felt base impregnated with a chromate pigmented compound which is claimed to render the material fire and corrosion resistant. Originally intended as a substitute for low-

(*Continued on page* 256)

Specify "NORTON RESINOID"

For Fast Cutting Action

Grinding wheels on portable grinders are not treated gently. They need abrasive grains that are strong and rugged as well as sharp. Laboratory control at the Norton electric furnace plant followed by special crushing and screening methods results in abrasives with the necessary chemical and physical characteristics. When used in a wheel of the proper grade (bond strength) for the job they combine fast cutting action with economical wheel life.

For Smooth Cutting Action

Constantly improved resinoid bond formulae developed by the Norton research laboratories are such that under the heat of grinding the bond softens just enough to act as lubricant. Loading is decreased and the wheels have a smooth grinding action. And the resinoid bond has just enough resiliency to make the wheels hug the work and prevent bouncing.

A Norton abrasive engineer will specify just the right resinoid wheels for your portable grinders.

NORTON COMPANY
WORCESTER 6, MASS.

W-999

NORTON ABRASIVES

A MAJOR IMPROVEMENT IN FIRE BRICKS!

Machine Made By An Exclusive Patented Process

CROSS GRAINED REFRACTORIES

Have Longer Life and Reduce Maintenance Cost

Just as the flow lines in steel determine the life of parts made from it, so does "cross-graining" add up to 50% to the life of *Chicago Retort Fire Bricks.* Perfected by our ceramic engineers in 1940, this feature consists of a grain structure arranged at right angles to the operating surface, which reduces spalling and reinforces the lining against erosion. This and numerous other advantages you will find in the refractories of *Chicago Retort*—a pioneer, for 66 years, in fire clay products.

Save Time & Labor! Use Chicago Retort's FITTED LADLE LININGS For Crane and Cylindrical Ladles. Shapes Designed To Fit All Standard Sizes

ANTI FLUX

CHICAGO RETORT & FIRE BRICK COMPANY

Manufacturers Since 1879

208 SOUTH LA SALLE STREET • CHICAGO 4, ILLINOIS

Only a Worm Gear Hoist IS SO FLEXIBLE TO INSTALL

THE use of worm gear speed reduction in Reading Electric Hoists allows you to fit the hoist to your plant layout subject to local conditions of clearance, space available, etc. These hoists are composed of four interchangeable units — suspension unit, hoisting unit, motor unit and control unit. Under this Reading Unit Construction Plan, 144 different combinations of these units are available to give you special equipment at the low cost of standard parts.

Other advantages of this worm gear construction are: quiet operation, compact size, and low cost of maintenance because of only three moving units in the hoisting mechanism.

It will pay you to investigate the money saving features of Reading Electric Hoists. For full technical information, write for Bulletin 1004.

READING CHAIN & BLOCK CORPORATION
2108 ADAMS ST., READING, PA.

CHAIN HOISTS • ELECTRIC HOISTS • OVERHEAD TRAVELING CRANES

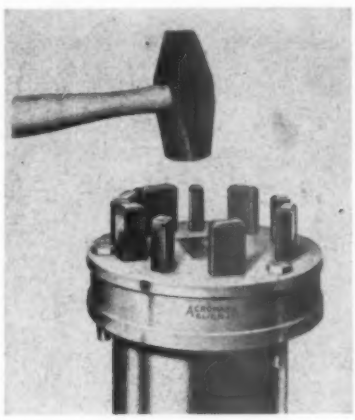
READING HOISTS

(*Continued from page* 254)

pressure rubber gaskets in marine ventilating systems, the material has been found applicable to many other applications such as joint seals in water, fuel oil and diesel oil systems as well as for air lock and refrigerator doors. Available in 1/16 and 1/8-inch thicknesses, the material may be obtained in factory pre-cut gaskets or in sheet form.

Sealing Film: Charles Bruning Co. Inc., 4754 Montrose avenue, Chicago 41, has developed a transparent film in rolls from 8 inches to 24 inches in width and in length from 10 to 20 yards, to be used as a protective overlay for drawings, tracings, prints, etc. It is claimed that it is waterproof, dustproof, greaseproof and washable. The adhesive will stick to practically any surface. Can be written on with pen or pencil. Any changes or corrections can be made by erasing or rubbing with a moist cloth.

Die Holder: Acromark Co., Elizabeth 4, N. J., has placed on the market a new style masking die holder to facilitate the marking of parts too large to be handled. Shown in the accompanying illustration the holder is self contained,



and holds all marking dies in position for stamping. Face of each die is protected so that it may be placed in marking position without scratching work. It is claimed that an impression can be made with a single hammer blow on each die, and bounce or chatter marks practically are eliminated.

Wet Belt Surfacer: Porter-Cable Machine Co., Syracuse 8, N. Y., announces a new development in which all the advantages of wet belt machining may be applied to line contact grinding and polishing as well as platen machining. The new device is said to retain all the advantages of the former dry belt machine: Abrasive on the belt exposed for action; resiliency of the contact roll permits the abrasive to dig in; resiliency eliminates chatter; balanced belt and contact roll; an accurate platen above

(*Concluded on page* 258)

Where Aluminum Alloy Castings of top quality and complete dependability are needed, our Alloys are in demand in large quantities. One of these, for example, is 355.

We furnish millions of pounds of this Alloy for the production of high strength castings for tank and liquid-cooled aircraft engines —engines that must be absolutely DEPENDABLE because lives and battles depend on their performance.

This is further evidence of our ability to furnish regularly, large quantities of controlled Aluminum Alloys for precision castings.

When War ends, and materials are needed to help build a better, brighter world, we will have Laboratory-Controlled Re-Melt Aluminum Ingot available for the most demanding requirements—and its lower cost will help you meet intense Post-War Competition.

Aluminum Research Institute

111 West Washington Street, Chicago 2, Illinois

MEMBER · ALUMINUM RESEARCH INSTITUTE

Federated Metals Division
American Smelting & Refining Company
New York City 5 and Branches

General Smelting Company
Philadelphia 34, Pennsylvania

Samuel Greenfield Co., Inc.
Buffalo 12, New York

William F. Jobbins, Inc.
Aurora, Illinois

R. Lavin & Sons, Inc.
Chicago 23, Illinois

The National Smelting Co.
Cleveland 5, Ohio

Niagara Falls Smelting & Refining Corp.
Buffalo 17, New York

Sonken-Galamba Corporation
Kansas City 18, Kansas

U. S. Reduction Co.
East Chicago, Indiana

Aluminum and Magnesium, Inc.
Sandusky, Ohio

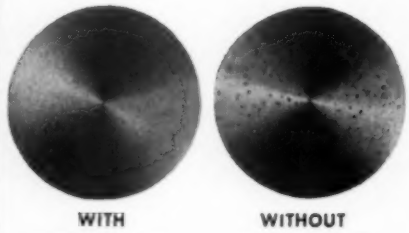
The American Metal Company Limited
New York City 6

Apex Smelting Co.
Chicago 12, Illinois

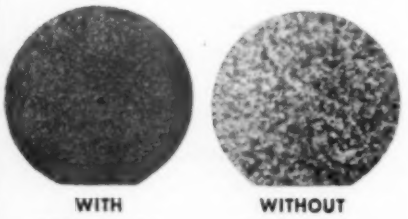
Berg Metals Corporation
Los Angeles 11, California

The Cleveland Electro Metals Co.
Cleveland 13, Ohio

FOSECO
DEGASERS
MAKE BETTER ALUMINUM
Castings!



WITH DEGASER #7 | WITHOUT DEGASER #7



WITH DEGASER #8 | WITHOUT DEGASER #8

FOSECO Degasers remove gases and oxides; eliminate pinholes; improve physical properties.

Degaser No. 7 for degassing. Degaser No. 8 for degassing and grain refinement.

Write for samples, make your own test.

FOUNDRY SERVICES, INC.
280 Madison Avenue
New York, N. Y.
DEPT. F

(*Concluded from page 256*)

the contact roll grinds flat and square. The wet belt eliminates heat and dust, distortion, warping, checking, cracking, etc. The 4-inch belt works over a considerable area.

Tramrail System: Forker Corp., 1826 East 47th street, Cleveland 3, announces a new tramrail system including several one-piece rolled steel rail sections of simple design and heavy construction suitable for various span and load conditions. Trollies are available for chain and electric hoists. Other items include monorail switches, monorail cranes, and below-the-hook devices. A special feature is shielded electrification, a safe means of getting power to trollies and cranes with live conductor bars covered against contact by workmen.

Mounting Press: Precision Scientific Co., 1750 North Springfield avenue, Chicago 47, has designed a new air-operated specimen mounting press. The device illustrated utilizes air which is set automatically by a constant pressure reducing valve to maintain pressure on the specimen during curing. It is claimed that use of air pressure assures uniform specimens identical in size and hardness, improves polishing characteristics, and greatly reduces the operator's time.

Vise Wrench: A new improved vise wrench has been designed by Knu-Vise Inc., Detroit 16. Milled teeth of vise are alloy steel forgings welded to stamped, heat treated body. Made in 10-inch length weighing 18 ounces and in 7-inch length weighing 13 ounces the vise may be used to hold work for drilling, welding, riveting, grinding, or as a pipe wrench. A locked grip can be maintained to leave both hands free. Normal hand grip is said to attain a clamping pressure at the jaws up to 1 ton.

Locking Pins: Driv-Lok Pin Co., 565 West Washington boulevard, Chicago 6, announces a complete line of standard and special self-anchoring, vibration-proof pins designed to replace taper pins, keys, cotter pins, set screws, rivets, etc. The pins are pressed or driven into standard drilled holes. Flutes on the sides provide a resilient, self-locking element which, it is claimed, will hold indefinitely under shock or vibration conditions. Pins are available in sizes from $\frac{3}{64}$ to ½-inch diameter, and from $\frac{1}{8}$ to 4½-inches in length, in any material and in a wide variety of types.

Polishing Wheels: Norton Co., Worcester, Mass., is marketing a line of solid polishing wheels for deburring, finishing and polishing operations. Wheels are available in three types which include cork resinoid, fiber resinoid, and resilient rubber. Fiber resinoid type wheels are composed of abrasive grains mixed with cotton fibers and held together with resinoid bond; rubber wheels similarly are comprised except that soft rubber is used, and in the cork wheels the composition is abrasive grain, cork and resinoid bond. Wheels may be obtained in different grain sizes and structures.

Power Brush: Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland, announces a new power brush with a cutting rate four times as great and a bushing life three times longer than the best fine wire brushes manufactured previously. The new brush is a 12-inch monitor section filled with 0.005-inch power brush wire, especially suited for removing burrs without damaging adjacent parts of nonferrous and ferrous metals, also for rubber parts and other materials offering considerable resistance. It is claimed that fast action reduces operator fatigue.

Metal Detector: Illinois Testing Laboratories, Inc., 420 North La Salle street, Chicago 10, has developed a metal detecting device which may be adapted for use under many varying conditions. The unit includes search coil, amplifier and supervisory signals. Practically any size opening may be provided for hand or gravity feed, or for use with continuous conveyor. Tramp iron may be detected in nonmetallic materials, or in metallic nonmagnetic materials. Each unit is built to order to meet individual requirements in size of opening and in sensitivity.

Tool Holder: Armstrong Bros. Tool Co., 301-357 N. Francisco avenue, Chicago 12, announces extension of the line of carbide tool holders and carbide tipped cutters. Tool holders especially designed for use with carbide tipped cutters now come with straight, right offset, or left offset shanks, each in seven sizes. Cutters come tipped with carbides of two grades, red for machining steel and gray for machining iron and nonferrous metals.

Better Bench Work ... Better Castings

Working with your head in the clouds is never good business. But when these clouds are *dust*, and when the quality of your product and the success of several operations to follow depend upon *always* doing the job right, it's high time to look for the "silver lining."

Ask any bench molder who has worked in murky foundry atmosphere and then in the *healthful* environment modern ventilation provides. He'll tell you—and you *know* he's right—that clean fresh air "ups" output, quality, *morale*.

That's why Burndy Engineering Company, Bronx, New York, supplement their other copper foundry ventilation with *cross air currents* from additional Propellair fans.

Twenty Propellair fans at Burndy help to maintain high standards in product quality and working conditions.

PROPELLAIR FANS DO SUCH A FINE JOB because airfoil-section blades of varying pitch, curvature, and *thickness* operate within an airfoil-principle curved entrance ring to create a high-volume axial flow of air over *entire* fan area, virtually without resistance.

Send for Catalog No. 10F. Learn how Propellair Airfoil Fans can help you solve your problems. There are types and sizes for every foundry need. Fourteen years of propeller-fan specialization, and sales engineers in 25 cities, are at your service.

"MOVING AIR IS OUR BUSINESS"

PROPELLAIR INC.
SPRINGFIELD · OHIO

Readers' Comment

Momentum a Factor

To the Editors:

In your Questions and Answers column of the January 1945 issue of The Foundry, you state in your answer to the second question on page 88, that static pressure of the iron is the only force motivating the raising of the cope. That statement is not quite true, for the momentum of the iron exerts a considerable force upon the cope at the instant that the iron comes into contact with the cope surface. It is an easy matter to raise the copes of some molds by hard pouring, while the selfsame molds will not be strained by easy pouring. This condition is due to the momentum of the iron and not to static pressure, which is the same in both cases. For this reason, the static pressure formula will not apply unless the pressure loss through friction in the mold will equal the force exerted due to the momentum.

Assuming that the iron rises on both cases with the same velocity, the "man with many years experience" of the question has roughly the right idea although he may not know why. A greater pressure due to momentum will be exerted on a mold having a large cope area or ribs and brackets if you wish, than it would on a similar mold with a smaller cope area and the ribs and brackets removed.

L. Richard Spann

53 *May street*
Naugatuck, Conn.

Spots in Aluminum

To the Editor:

In the January, 1945 issue of The Foundry, page 88, a question is submitted regarding black spots in aluminum castings.

I thought maybe I could contribute something on the subject, which is not mentioned in the answer printed on the same page. There have been several cases where similar black specks were observed in aluminum castings, and in those cases the trouble was traced to overheating the metal and the black specks were found to be aluminum oxide. When the temperature of the aluminum was held within the proper limits, say not over 1300° F., the trouble disappeared.

Richard H. Stone

Vesuvius Crucible Co.
Swissvale, Pa.

May Break 100 Yet

To the Editors:

So much has been said and written in the past few years about uncomfortable and unhealthy conditions in the foundry, conditions claimed to be responsible for present shortage of skilled and unskilled foundry labor, perhaps a word or two on the other side of the record may be justified and appropriate.

MANAGEMENT COUNSEL

George W. Hardy
Industrial Engineer

Industrial engineering, time and motion study, compensation methods, labor relations, cost records. Registered, licensed, professional engineer; B.S. degree, Mechanical Engineering, Purdue University. Was mechanical engineer with nationally known rubber manufacturing company, accountant and property valuations engineer with prominent oil refining company, tool design engineer with leading tool manufacturing company.

■

Mr. Hardy is a member of our staff of licensed, professional Engineers and Architects, all of whom are qualified to work closely with members of your company in helping to build a more effective business organization.

■

- Industrial Engineering
- Methods
- Work Standards and Costs
- Job Evaluation
- Wage Incentives
- Architecture
- Structural Engineering
- Civil Engineering

ASSOCIATED ENGINEERS INC.

Fort Wayne AEI Indiana

The foundry is not a garden of Arcady or a bower of roses dripping with perfume, brilliantly lighted and cheered by the twittering of nightingales. The same may be said of almost all manufacturing establishments. Normal men do not expect or pine to work in a kid glove and carnation-in-the-buttonhole atmosphere. The grime and dirt bugaboo has been played up principally by propaganda shooters, imaginary and would-be leaders of public opinion who never worked with their hands, except in writing opinions on subjects of which they knew little or nothing.

Serious as this flow of misinformation has been, it is not to be compared with the widely publicized vaporing of those who proclaim that the foundry industry should be added as a fifth member of the Four Horsemen of the Apocalypse as they gallop around, mowing down the population in heaps and windrows. From a purely philanthropic and altruistic viewpoint these modern crusaders are prepared to take any case on a contingent fee basis and prove that any disease or injury from arthritis to zymotic is caused by breathing the contaminated and dust laden air in the foundry.

Within the past few years several A.F.A. Chapters have staged meetings where the honored guests have been men who have been engaged in the foundry for periods ranging from 50 to 75 years.

What prompted these remarks was a letter I had recently from a town in Scotland where I served an apprenticeship to the trade 50 years ago. My old gaffer, still actively engaged in running the shop recently celebrated his 90th birthday! He liked his dram of Dugan's Dew o' Kirkintilloch in the morning, at noon, at night or in fact at any time, and was very partial to a little black cutty pipe constantly stuck in his jaw.

ONE OF THE OLD BOYS

San Mateo, Calif.

Swatting The Swastika

TO THE EDITORS:

Received the December issue of THE FOUNDRY, and thanks for printing my letter. I am sending you this swastika which was displayed and waved so proudly here in the streets of Luxembourg. Every home, store and building carried at least one. This is the proud symbol of the German race at whose command a single man almost led the world into the clutches of the swastika. Yet the tide of time was turned by a happy-go-lucky chap, who by all the greatest of militarists could not be made into a soldier after a military pattern.

To turn a man into a military pattern he first must be stripped of his pride, his thoughts and ambitions, and his will to live as a human being. Only after this has been done can a man be turned into a military machine of destruction. An American doughboy—the proud representative of the American spirit—is a fighter, not a soldier, a walker and not a marcher, a free thinker for himself, and does not like to be led around and told what to do. This so-called American SNAFU has proven himself against his foe, the patterned soldier of the swastika, and has torn this symbol from the beaches of Normandy, through France, defeated them in this break-through, and is now beginning to cram it down his throat in his own back yard, Germany.

We are located in a small village in a valley and the church bells are striking eight o'clock. There is much air activity around us. Spent New Year's Eve on

CORP. LOUIS M. WICK

bridge guard and as the church bells struck 12, all was quiet, yet when the bells were stilled and the New Year began, the guns about us opened up and turned the heavens about us into a burning hell for those on the receiving end.

The weather is getting colder and everything is covered with snow. We moved from France to Luxembourg and spent Christmas digging a foxhole. Here is hoping it will be my last foxhole I'll ever have to dig on Christmas. Wishing a Happy New Year for THE FOUNDRY.

CORP. LOUIS M. WICK

Somewhere in Luxembourg

Saginaw Depicts Role In War Effort

Contributions of the Saginaw Malleable Iron Division, Saginaw, Mich., to the war effort are described in an attractive 48-page booklet issued recently by that company. It details many of the malleable and steel castings the company is producing for war equipment and pays tribute to the efforts of the 3500 employes. Improvements in foundry methods since 1918 also are described.

Adopts Suggestion Award Plan

A new 40-page handbook containing details of Cooper-Bessemer Corp.'s recently adopted suggestion plan, is being distributed to the company's employes in its Mount Vernon, O., and Grove City, Pa., plants. The award system is based on payments for ideas suggested which increase efficiency and reduce costs. Copies of the handbook are available to industrial concerns.

Industry Briefs

PEERLESS Foundry Co. Inc., Indianapolis, manufacturer of warm air furnaces, suffered $250,000 loss Feb. 21 when fire destroyed the plant with the exception of the foundry department. Plans are being made to rebuild the plant as soon as possible.

• • •

American Engineering Co., Philadelphia, has acquired Cochrane Corp., Philadelphia, and Faraday Electric Corp., Adrian, Mich. Faraday manufactures electric signaling devices and specialized household appliances. Cochrane produces various products used in the industrial and power plant equipment fields.

• • •

Standard Stoker Co. Inc., Erie, Pa., has acquired controlling interest in the Read Machinery Co. Inc., York, Pa. In business since 1908, the Read company in peacetime manufactured bakery equipment and a variety of apparatus for chemical processing industries and currently is making war items.

• • •

Foundry equipment orders placed in January represented 422.4 per cent of the 1937-1939 monthly average, compared with 397.4 per cent in December and 378.3 per cent in January, 1944, according to the Foundry Equipment Manufacturers Association. Sales of repair parts were the largest in 10 months.

• • •

Montague Castings Co., Muskegon, Mich., was awarded the Army-Navy "E" Feb. 24 at ceremonies at the Muskegon Heights High School. A producer of gray iron castings, the company was started in Montague, Mich., in 1923 and was moved to Muskegon in 1942 when it was taken over by Paul M. Wiener, president.

• • •

Ottumwa Foundry Co., Ottumwa, Iowa, has had plans prepared by D. D. Morgan, Burlington, Iowa, for a foundry building 40 x 238 feet, costing about $50,000. Beling Engineering Co., 501 Fifteenth street, Moline, Ill., is consulting engineer.

• • •

Hines Flask Co., 3441 West 140th street, Cleveland, has awarded contract to the Esch Construction Co. for a masonry one-story addition to its plant, dimensions to be 88 x 48 and 60 x 240 feet, and to cost in excess of $80,000.

• • •

Mueller Co., Columbian Division, Chattanooga, Tenn., suffered fire damage estimated at $150,000 Feb. 15 when its No. 2 plant was destroyed following the igniting of oil stored in the plant.

• • •

Pacific Steel Casting Co., Berkeley, Calif., announces the retirement of Elam S. Shonk from the partnership, effective Feb. 1.

• • •

Production of tracklaying tractors in 1944 amounted to 34,066 units, with a dollar value of approximately $300,000,-

SIMPLE

WILLSON No. 5 and 45 Lightweight Respirators with easily replaceable filters protect workers. They remove harmful dusts and mists. Bureau of Mines Approvals for various hazards. Filters tested for low breathing resistance.

SAFE

Two sizes for wide range of faces assure safety of a good fit. Form molded rubber facepiece prevents leakage at edges. Adjustable headband and nose spring maintain tight seal.

COMFORTABLE

Comfort features of WILLSON Respirators make them easy to wear. Their light weight requires little headband pressure. Compactness permits full vision—safety goggles can be worn. Washable cotton FACELET* protects face.

*Trade Mark Reg. U. S. Pat. Off.

Get in touch with your WILLSON *Safety Service Distributor for full information. Or write Dept. FO-6.*

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON

PRODUCTS INCORPORATED

READING, PA., U.S.A. Established 1870

000, according to WPB. For 1945, the program calls for 38,693 tractors.

• • •

A stabilized wage rate of $1.50 an hour and a rate range of $1.50 to $1.65 an hour for patternmakers in all metal working production shops in the Chicago labor market area have been set by the regional War Labor Board.

• • •

W. O. Larson Foundry Co., Grafton, O., will alter and repair a portion of its foundry building and install additional equipment to increase war production, at cost of about $23,000.

• • •

D. & D. Foundry is the firm name under which Charles A. De La Grange and Gladys De La Grange have published a certificate that they are conducting business at 500 Pine street, El Monte, Calif.

• • •

Manhattan Rubber Mfg. Division of Raybestos-Manhattan Inc., Passaic, N. J., has been awarded the Approved Quality Control rating award of the Army Air Forces Air Technical Service Command, for meritorious industrial achievement.

• • •

Frantz Pattern & Foundry Co. is the firm name under which Irvin O. Frantz and Adele E. Frantz have published a certificate that they are conducting business at 2201 East Artesia street, Long Beach, Calif.

• • •

Acme Pattern Co., 128 East Third street, Flint, Mich., has been incorporated with $50,000 capital to manufacture metal and wood patterns, by Harold Dennee, 209 West Taylor street, Flint.

• • •

Building permit has been issued for construction of an addition to the foundry building of the Alloy Brass Co., Los Angeles, to cover an area of 50 x 110 feet and to cost approximately $10,000.

• • •

Excel Brass & Aluminum Foundry is the firm name under which Sol Tyroler and Leland G. Crabb have published a certificate that they are conducting business at 754 East Florence avenue, Los Angeles.

• • •

A. N. Culp has retired from membership in the firm of Pacific Brass Foundry, Los Angeles, and the business is being continued by William Eichenhofer.

• • •

Delta Mfg. Co., Milwaukee, has been awarded the fourth star to its Army-Navy "E" pennant.

• • •

Ziegler-Harris Co., Burbank, Calif., will build a new pattern and die shop, offices and work rooms at 2900 North Rowe avenue, to cost $10,000.

• • •

Seattle Brass Co., 4047 Seventh avenue, has let contract to the Austin Co., Cleveland, for a one-story 60 x 120-foot foundry building to cost about $50,000.

RADIANT FACINGS Since 1870

MANUFACTURED IN OUR OWN PLANT...

DISTRIBUTED FROM OUR WAREHOUSE

BILL GAGGER SAYS:

ON THE JOB After the Civil War and Every War Since—

RADIANT FACINGS

MAKING BETTER CASTINGS FOR 64 YEARS

•

WE MANUFACTURE

Core Compounds
Core Washes • Blackings
Plumbago • Seacoals
Parting Compounds
Tripoli—Low Silica—Liquid
Core Pastes and Binders
Shake Bag Facings
Anti-piping Compounds
"Ferrograph" Graphitizer
Special Facings & Compounds

WE WAREHOUSE

Purite • Goulac • Glutrin
Bentonite • Silica Flour
Soapstones and Talcs
Truline Binder

The Smith Facing & Supply Co.

1857 Carter Rd., Cleveland, Ohio

NEW TRADE PUBLICATIONS . . .

TACHOMETERS — Bulletin No. 44-1, published by Jones Motrola Co., Stamford, Conn., describes four models of individual-mount tachometers and a multirange portable hand tachometer. The bulletin contains views of the tachometers, RPM ranges available, mounting dimensions, and includes prices, a section on use and operation, and general installation data.

VENTILATING EQUIPMENT — A colorful, 8-page brochure, published by Ilg Electric Ventilating Co., Chicago 41, gives pictorial information concerning its research laboratory and scenes showing testing and research processes. A short summary describes the laboratory, devoted to the scientific study of air.

AIR OPERATED DEVICES — Airop Inc., Dearborn, Mich., has issued a 6-page folder showing photographic reproductions of applications of its air operated clamps and cylinders, range of installations, principal features, and a blueprint of construction. Basic diagram on single unit installation is presented, as well as price list of clamps and cylinders.

WELDING ELECTRODES—A new bulletin, L6348, released by Allis-Chalmers Mfg. Co., Milwaukee, gives a complete description of its line of electrodes and includes separate charts on physical properties of weld metal for each electrode as well as on recommended current values. The new electrodes are a-c and d-c types and are easily identified by official AWS classification numbers.

AIR HANDLING — B. F. Sturtevant Co., Hyde Park, Boston 36, has prepared a 199-page pocket size catalog and engineering data book, describing a complete line of air handling equipment applicable to heating, ventilating, air conditioning, drying, dust control, and other industrial systems. The catalog includes engineering and design data, formulas and tables, and a psychometric chart for determining values of air properties in heating, cooling, humidifying and dehumidifying problems.

CABLE CONNECTIONS—A new 12-page catalog describes a complete line of cable connections for electric welding manufactured by Tweco Products Co., Wichita 7, Kans. The items shown include electrode holders, plain and insulated, ground clamps, cable connectors, machine terminals, cable lugs, and jig and fixture clamps. Price and parts list are shown.

BELT SURFACER — An 8-page bulletin offered by Porter-Cable Machine Co., Syracuse 8, N. Y., describes a new wet belt surfacer with automatic feed table. The feed table, used for the first time on a wet belt surfacer, cuts operating time, leaves the operator free to prepare for the next cycle as the stock is being machined, and hydraulically controls speed, pressure, finish and size. Coolant and grindings or chips fall into a large drawer where the chips are trapped and easily cleaned.

FACE SHIELDS — Boyer-Campbell Co., Detroit 2, has published a new 4-page catalog, FC 1044-10M, which describes a new series of face shields. For each model there is a choice of three different thicknesses and sizes of cellulose acetate windows, also three different sizes of 24-mesh screen windows for heat protection and a fiber front for scarfing and welding. All parts are interchangeable. Complete specifications and price list are included.

SAFETY AWARD: *Valve and foundry departments of American Car & Foundry Co. at Detroit, employing approximately 400 men, won the ACF award for its record of no lost-time accidents in 1944. Shown at the presentation, left to right, are: W. R. Kottsieper, manager, valve department, New York; Robert Clade, works manager, Detroit; Karl N. Searles, general safety supervisor, New York, and James L. Mahon, district manager, Detroit*

X-RAY SPECTROMETER — North American Philips Co. Inc., New York 17, has issued an announcement of a new Geiger-Counter focusing spectrometer, invaluable for process control in the paint, chemical, ceramic, rubber and metallurgical fields. It provides a new method of making quantitative and qualitative analyses of crystalline and certain amorphous substances. Descriptive material included covers method of operation and gives specifications for the spectrometer proper, transformers, stabilizer, scaling unit, power supply, frequency meter, impulse counter, Geiger unit, and X-ray tube.

ELECTRIC HAND TOOL—A new 4-page bulletin, Form D-10M-1044, offered by Precise Products Co., Racine, Wis., contains illustrations and important features of a high-speed electric hand tool, designed to operate at 35,000 rpm, develops 1/6 hp and weighs only 35 oz.

FLOOR CLEANER — Bulletin No. 81.5-A, issued by G. H. Tennant Co., Minneapolis 11, announces a floor cleaning machine that eliminates scraping, chemicals, soap and water. A heavy duty 16-inch diameter drum type steel brush, revolving at 1725 rpm, driven by an electric or gasoline motor, throws bits of metal, etc., into a built-in pan hopper. A vacuum fan sucks lighter material into the bag. The machine may be used for floor sanding and for steel wool buffing.

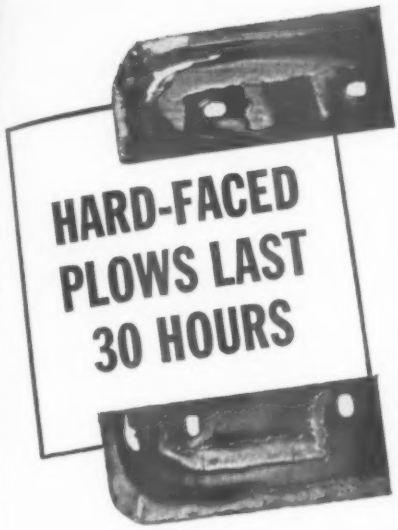
GRINDERS—A four-page brochure in color describing a new grinder patented by Norton Co., Worcester 6, Mass., which is said to lengthen tool life, increase production, reduce inventory of production tools and to be easily adapted to tool room procedure, is available upon request.

GAS ANALYSIS APPARATUS—Burrell Technical Supply Co., Pittsburgh 19, has available upon request a new 96-page gas analysis catalog, No. 80, containing a manual for gas analysts describing the latest methods in industrial gas analysis, and a catalog of gas analysis apparatus giving detailed information on modern equipment.

X-RAY AND RADIUM PROTECTION — Bar-Ray Products Inc., Brooklyn 32, N. Y., offers technical literature on X-ray and radium protection, together with lead products catalog. Included are data of the United States Bureau of Standards on X-ray protection which covers general recommendations, electrical protection, equipment, film storage, etc.

SWING BOOM CRANE — Catalog No. 58, a 24-page illustrated booklet available from Silent Hoist & Crane Co., Brooklyn 20, N. Y., contains photographs and diagrams, concise specifications, and actual views of practical application of a mobile swing boom crane for use in loading, unloading and transporting of materials, from 1 to 10 tons.

COUPLINGS — A new 8-page book, No. 2045, recently issued by Link-Belt Co., Chicago, gives sizes, dimensions



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and list prices of flexible, rigid flanged face and compression type and roller chain couplings. Information is also included on two styles of revolving and stationary-mounted protective casings of plastic and steel for roller chain couplings.

BLAST CLEANING — Pangborn Corp., Hagerstown, Md., has issued a new 24-page booklet featuring unusual problems in air and airless blast cleaning that require special equipment for production handling. Almost every known method of handling metals to be processed is represented, including bomb cleaning installations, machines for automatic descaling of coil springs, bar stock, and for cleaning propeller blades, subassembly parts, car wheels, aluminum cylinder blocks, truck and bus forgings and miscellaneous castings.

AIR HEATERS — Bulletin No. 137, offered by J. O. Ross Engineering Corp., 350 Madison Ave., New York 17, describes a new type heater being built in a 500 F to 600 F temperature range, using the recirculation of gases. The steel interchanger is located over the combustion chamber, the air to be heated passing along the outside and the combustion gases passing through the tubes. Fuel is completely burned in the combustion chamber, the exiting hot gases being diluted with the cooler recirculated gases brought back from the heater exhaust gas outlet by means of a fan. The mixture then enters the tubes at not more than 1000 F. Oil or gas may be used as fuel.

A new brochure describing the modern laboratory of the company at New Brunswick, N. J., which is equipped to permit commercial tests to reproduce actual field conditions is also available upon request. The laboratory facilities are available to companies seeking the most efficient methods for processing.

CONVEYORS — A new catalog, No. 308, published by Standard Conveyor Co., North St. Paul, Minn., is a handy reference for all conveyor needs. It is indexed for 46 different industries and also by types of conveyors and contains complete description of each type of conveyor, instructions on use and a table for selecting the conveyor best suited for a given job.

MELTING FURNACES — Stroman Furnace & Engineering Co., 300 West Adams St., Chicago 6, has published a 6-page Bulletin, No. 75, illustrated in color, and containing descriptions of furnaces, blowers and other melting room accessories. Hydraulic tilt, manual tilt, stationary crucible melting, stationary iron pot melting, and stationary super-heating or melting furnaces are among the types illustrated, with data describing the use of each type.

ALLOYS AND CHEMICALS — Molybdenum Corp. of America, Pittsburgh, has issued a new 20-page folder giving technical data and uses of molybdenum, tungsten and boron in their available forms. Similar information is also contained covering metal powders and chemicals.

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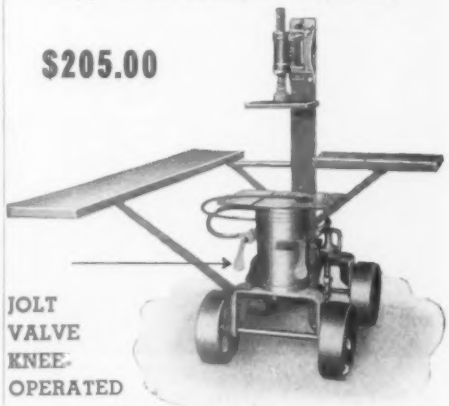

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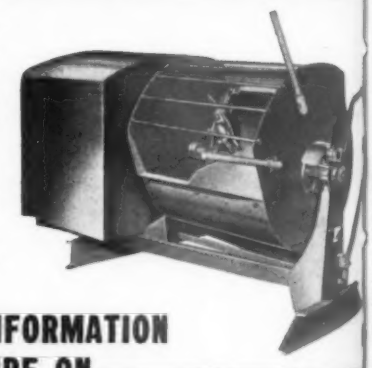

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